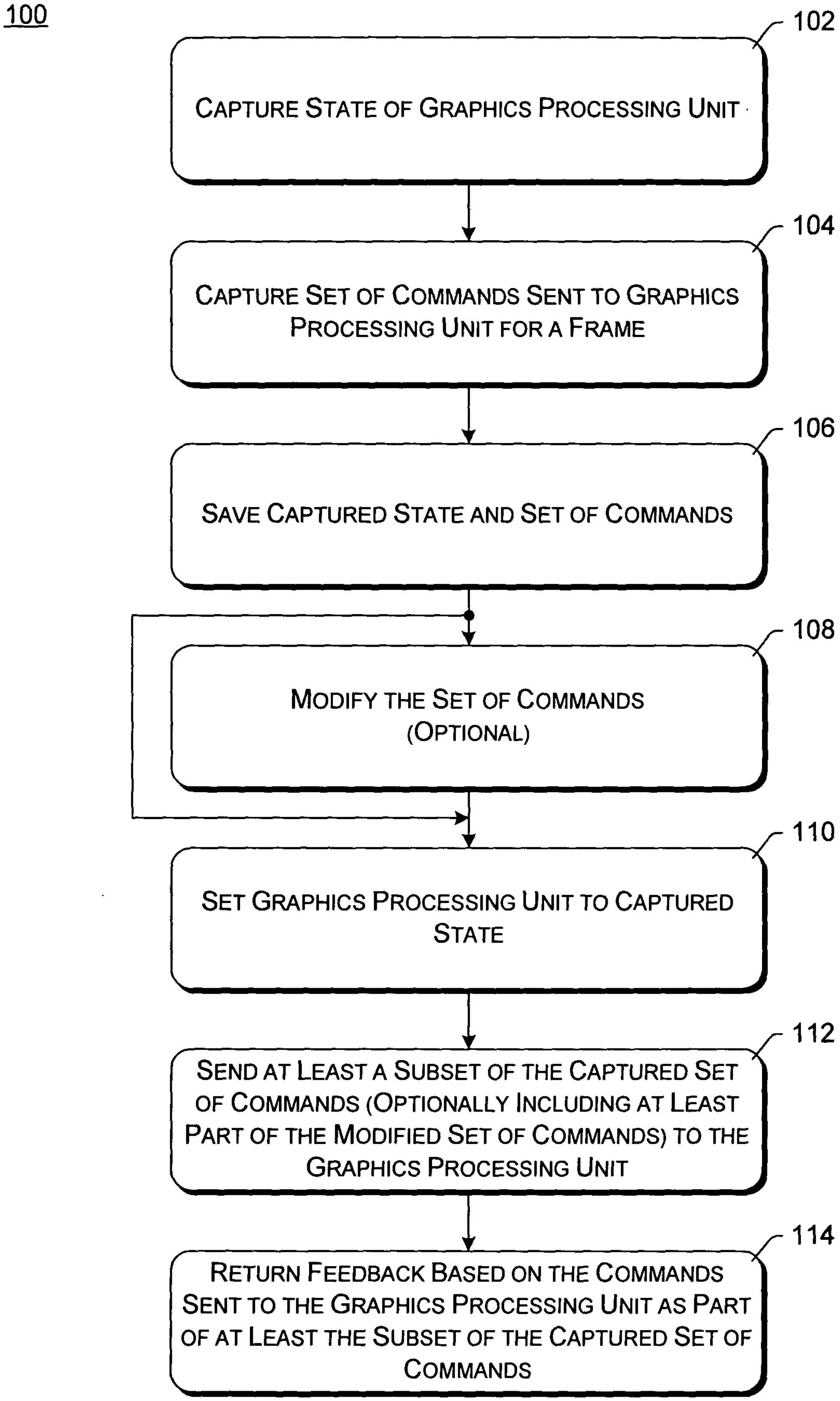

100
102
CAPTURE STATE OF GRAPHICS PROCESSING UNIT
104
CAPTURE SET OF COMMANDS SENT TO GRAPHICS PROCESSING UNIT FOR A FRAME
106
SAVE CAPTURED STATE AND SET OF COMMANDS
108
MODIFY THE SET OF COMMANDS (OPTIONAL)
110
SET GRAPHICS PROCESSING UNIT TO CAPTURED STATE
112
SEND AT LEAST A SUBSET OF THE CAPTURED SET OF COMMANDS (OPTIONALLY INCLUDING AT LEAST PART OF THE MODIFIED SET OF COMMANDS) TO THE GRAPHICS PROCESSING UNIT
114
RETURN FEEDBACK BASED ON THE COMMANDS SENT TO THE GRAPHICS PROCESSING UNIT AS PART OF AT LEAST THE SUBSET OF THE CAPTURED SET OF COMMANDS

Fig. 1

Docket No.: MS1-1671US
Inventor(s): Kyle R. Johns and J. Andrew Goossen
Title: Facilitating Performance Analysis for Processing

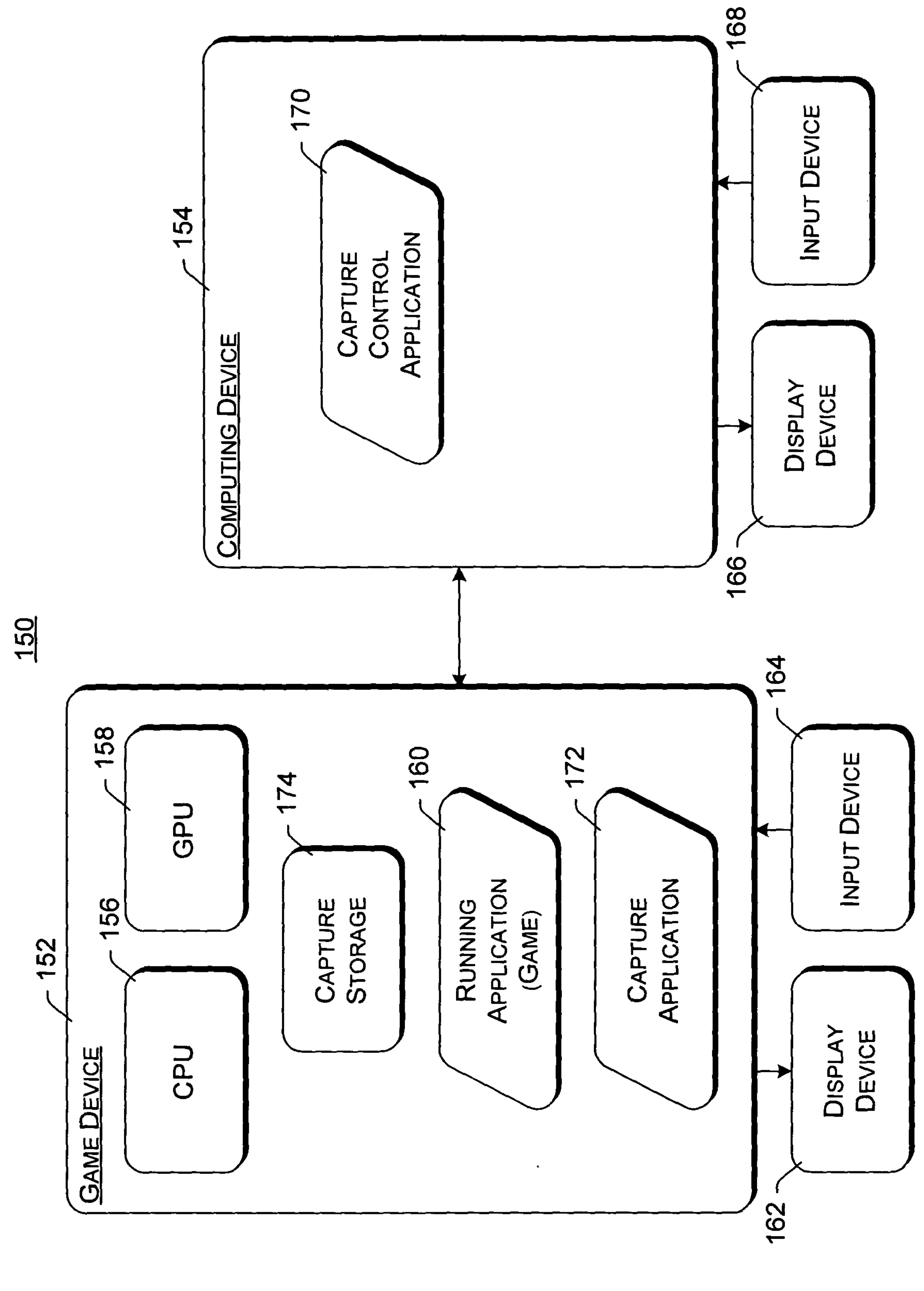


Fig. 2

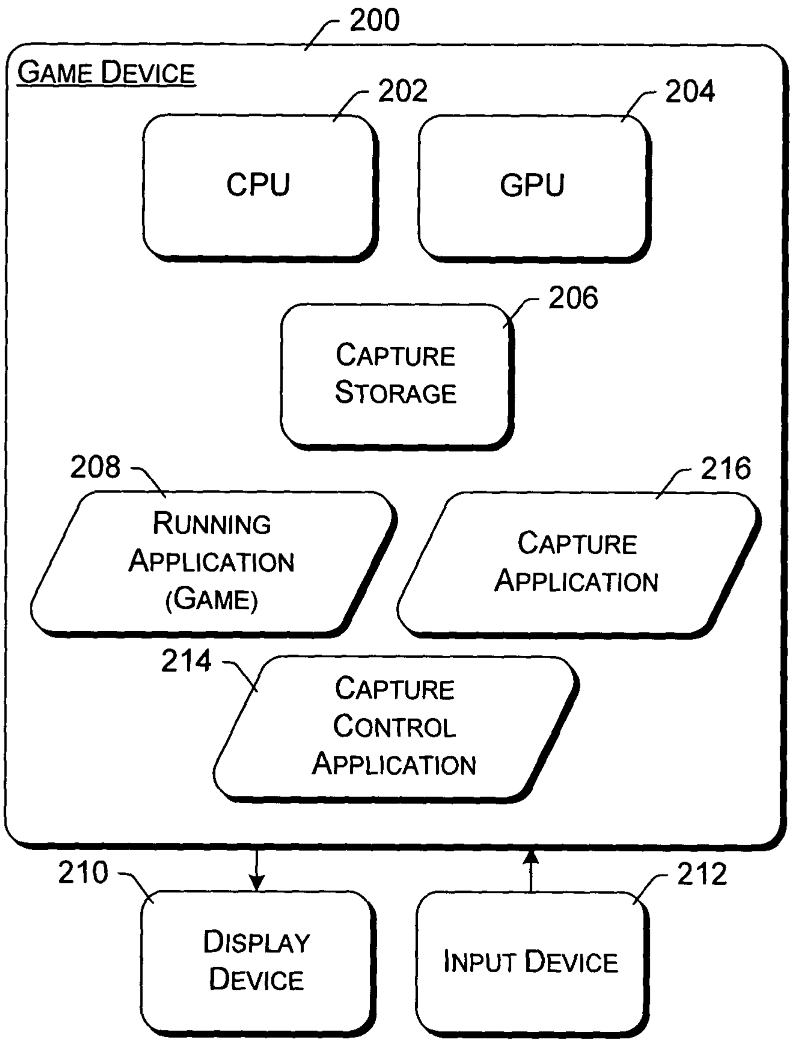

200
GAME DEVICE
202
CPU
204
GPU
206
CAPTURE STORAGE
208
RUNNING APPLICATION (GAME)
216
CAPTURE APPLICATION
214
CAPTURE CONTROL APPLICATION
210
DISPLAY DEVICE
212
INPUT DEVICE

*Fig. 3*

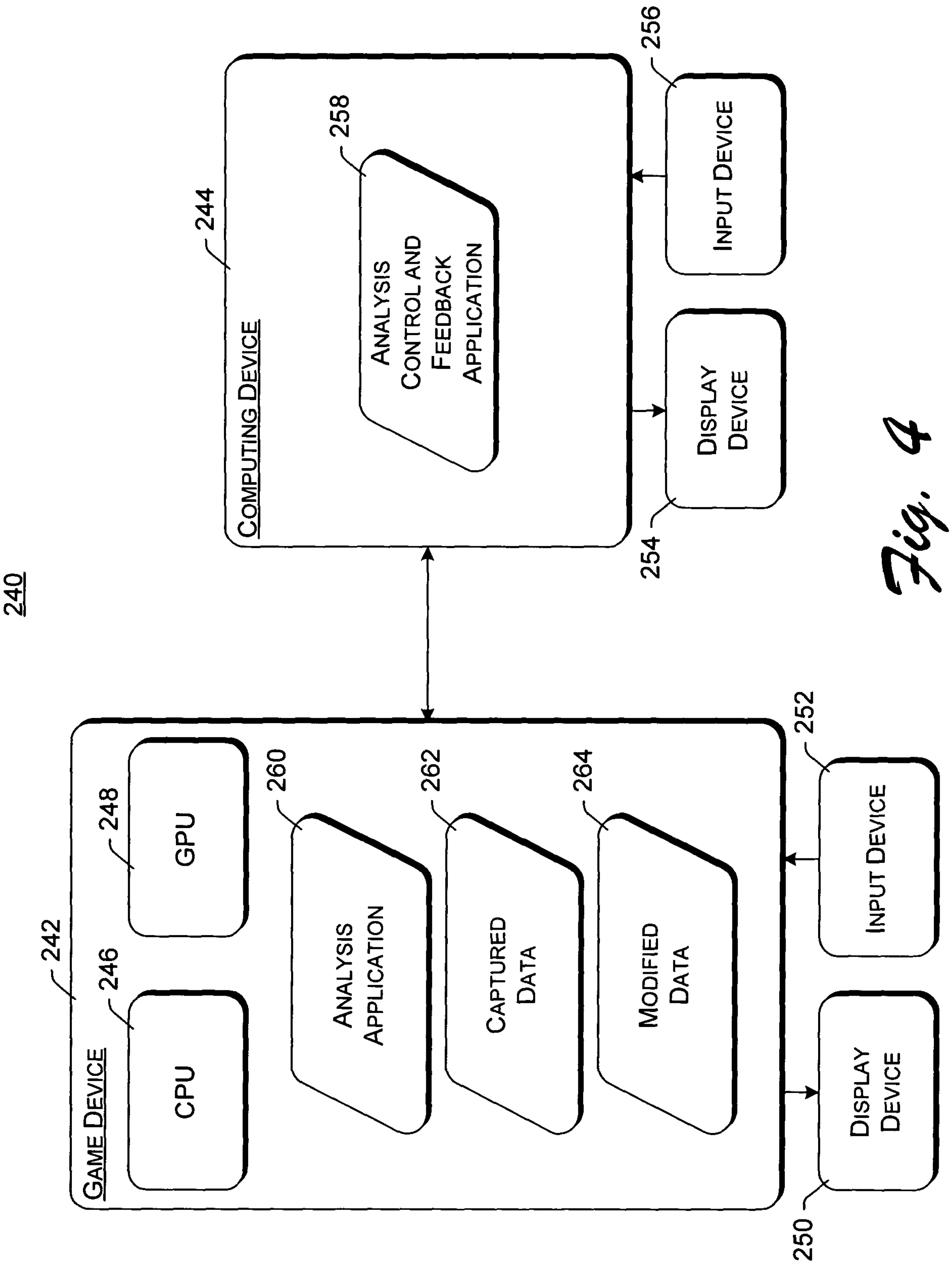

240
Game Device
242
CPU
246
GPU
248
Analysis Application
260
Captured Data
262
Modified Data
264
Display Device
250
Input Device
252
Computing Device
244
Analysis Control and Feedback Application
258
Display Device
254
Input Device
256

Fig. 4

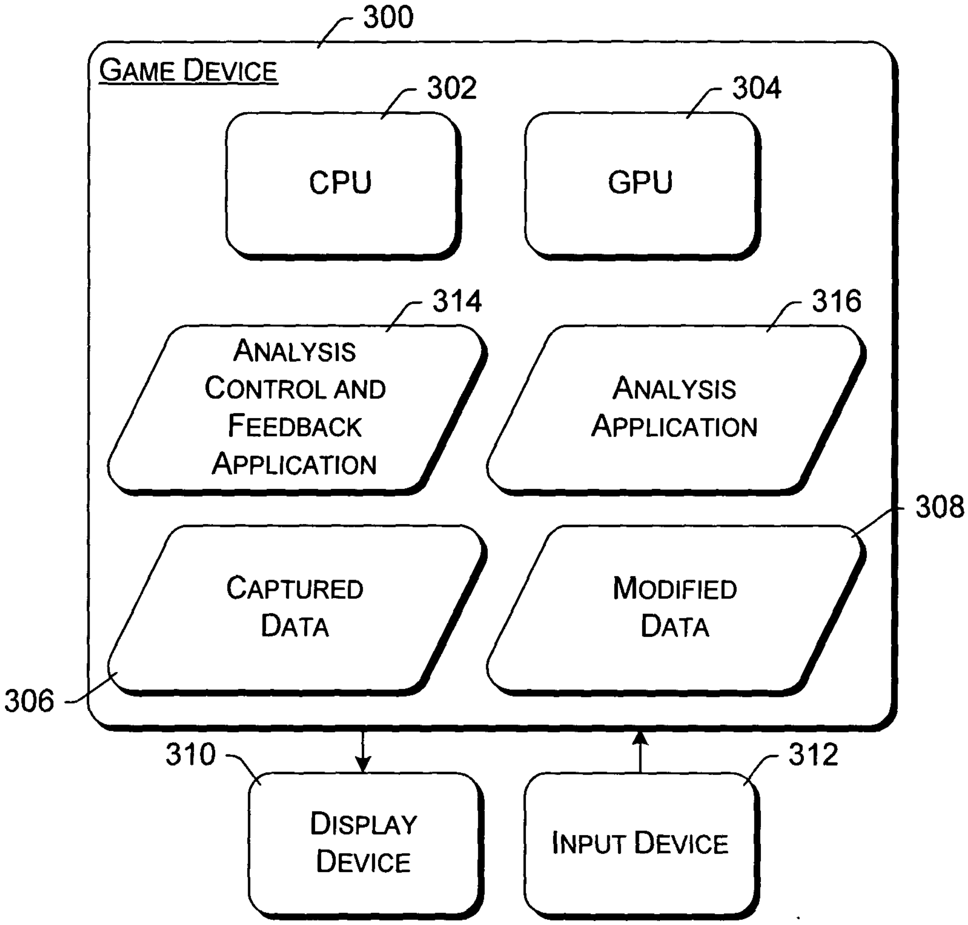
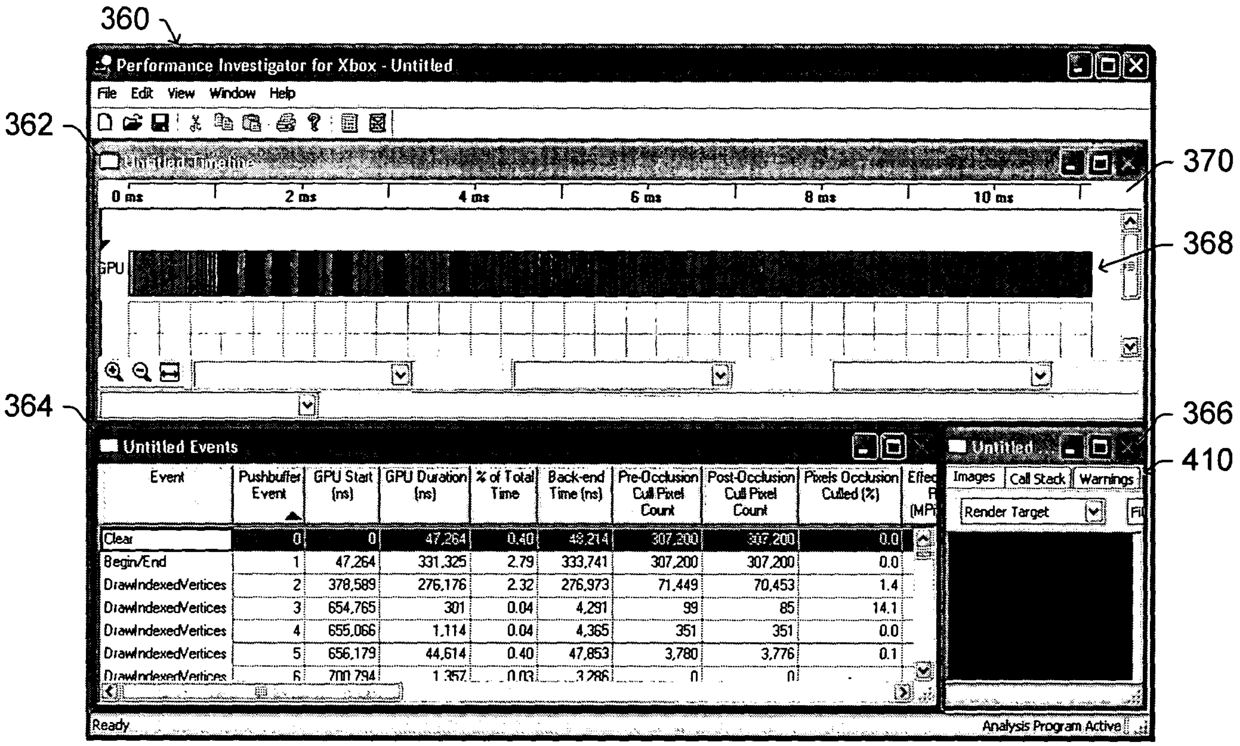

300
GAME DEVICE
302
CPU
304
GPU
314
ANALYSIS CONTROL AND FEEDBACK APPLICATION
316
ANALYSIS APPLICATION
308
CAPTURED DATA
MODIFIED DATA
306
310
DISPLAY DEVICE
INPUT DEVICE
312

*Fig. 5*



| Event | Pushbuffer Event | GPU Start (ns) | GPU Duration (ns) | % of Total Time | Back-end Time (ns) | Pre-Occlusion Cull Pixel Count | Post-Occlusion Cull Pixel Count | Pixels Occlusion Culled (%) | Effec<br>F<br>(MPi |
|---|---|---|---|---|---|---|---|---|---|
| Clear | 0 | 0 | 47,264 | 0.40 | 48,214 | 307,200 | 307,200 | 0.0 | |
| Begin/End | 1 | 47,264 | 331,325 | 2.79 | 333,741 | 307,200 | 307,200 | 0.0 | |
| DrawIndexedVertices | 2 | 378,589 | 276,176 | 2.32 | 276,973 | 71,449 | 70,453 | 1.4 | |
| DrawIndexedVertices | 3 | 654,765 | 301 | 0.04 | 4,291 | 99 | 85 | 14.1 | |
| DrawIndexedVertices | 4 | 655,066 | 1,114 | 0.04 | 4,365 | 351 | 351 | 0.0 | |
| DrawIndexedVertices | 5 | 656,179 | 44,614 | 0.40 | 47,853 | 3,780 | 3,776 | 0.1 | |
| DrawIndexedVertices | 6 | 700,794 | 1,357 | 0.03 | 3,286 | 0 | 0 | - | |

*Fig. 7*

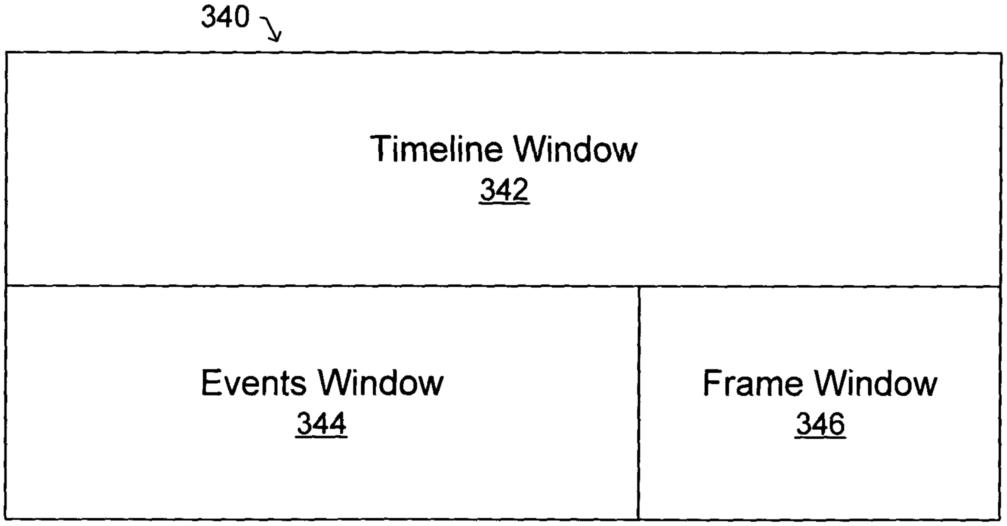


*Fig. 6*

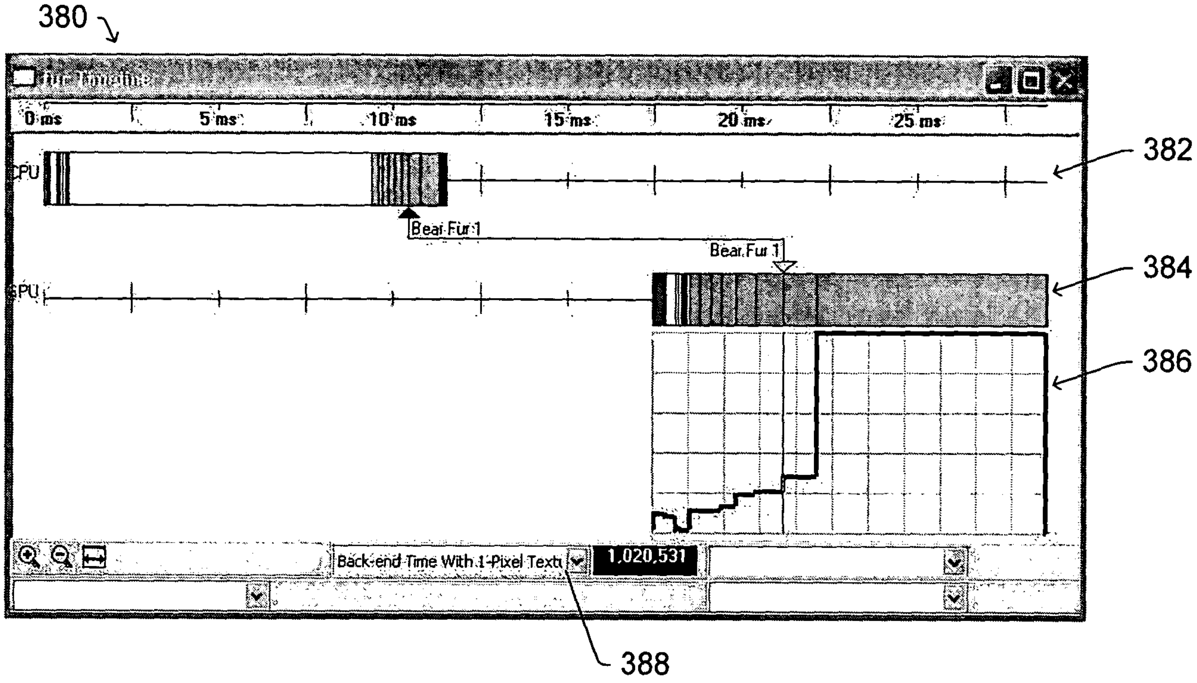
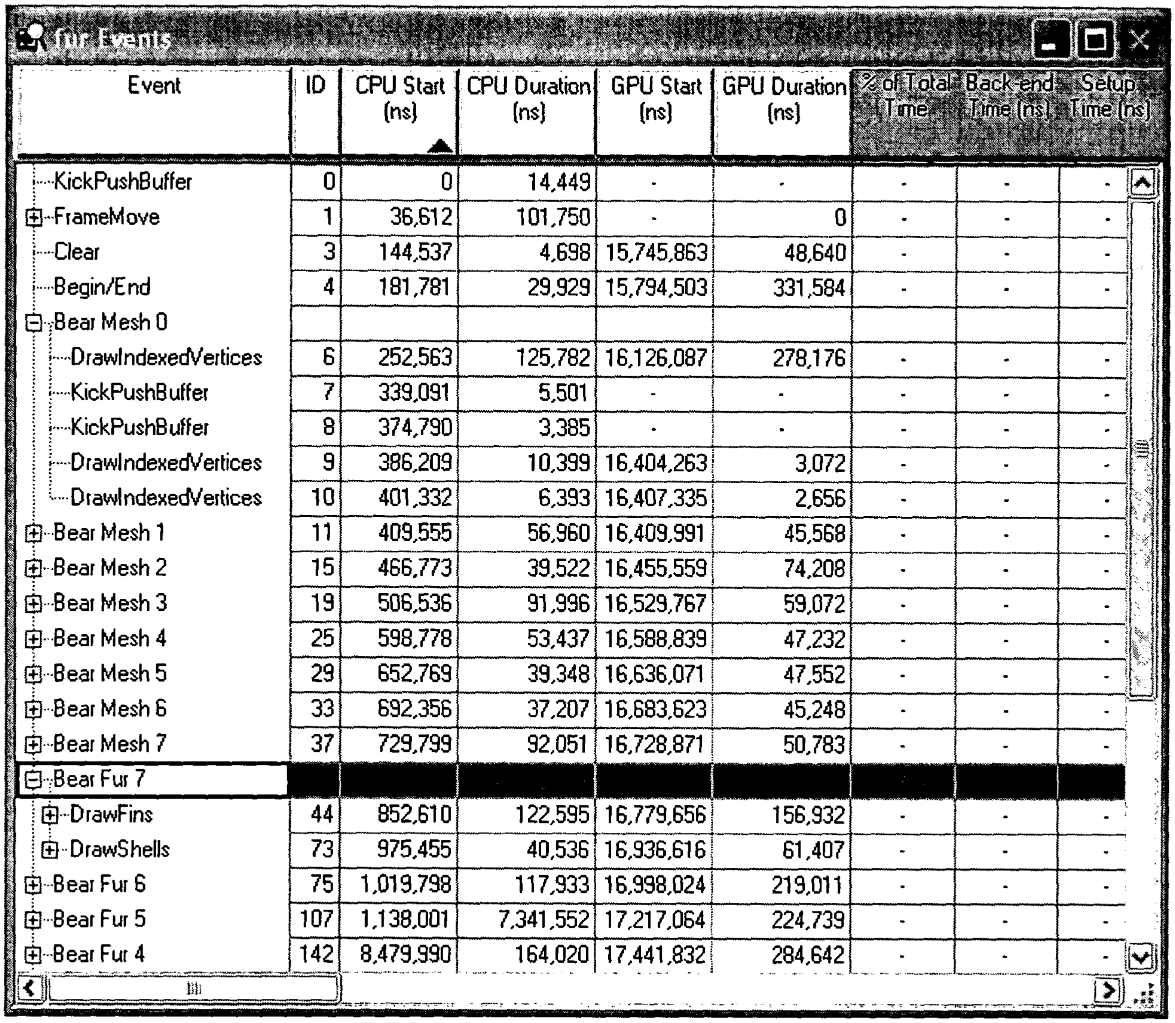

380
The Timeline
0 ms
5 ms
10 ms
15 ms
20 ms
25 ms
CPU
Bear Fur 1
Bear Fur 1
GPU
382
384
386
Back-end Time With 1-Pixel Textu
1,020,531
388

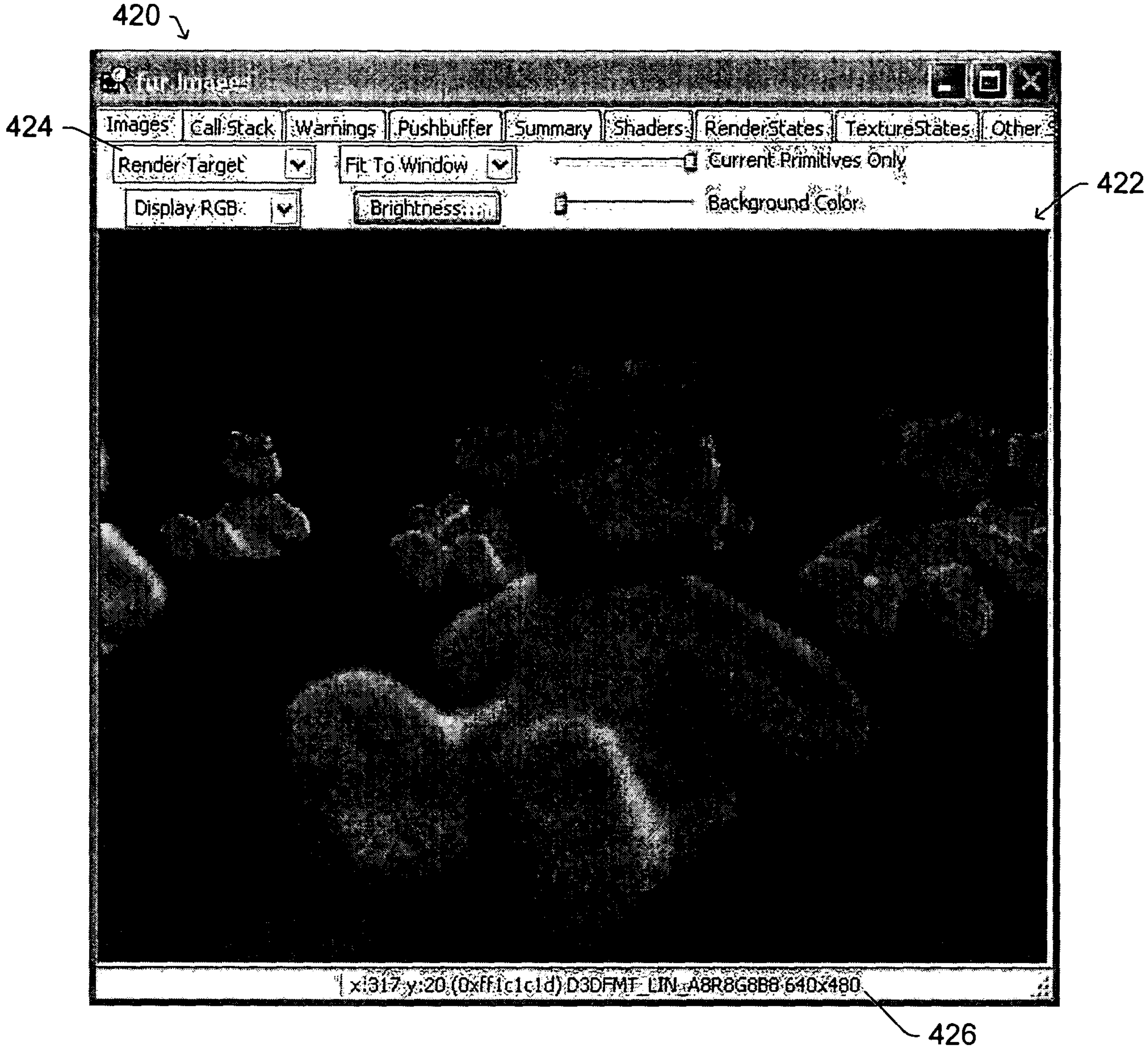
*Fig. 8*

400



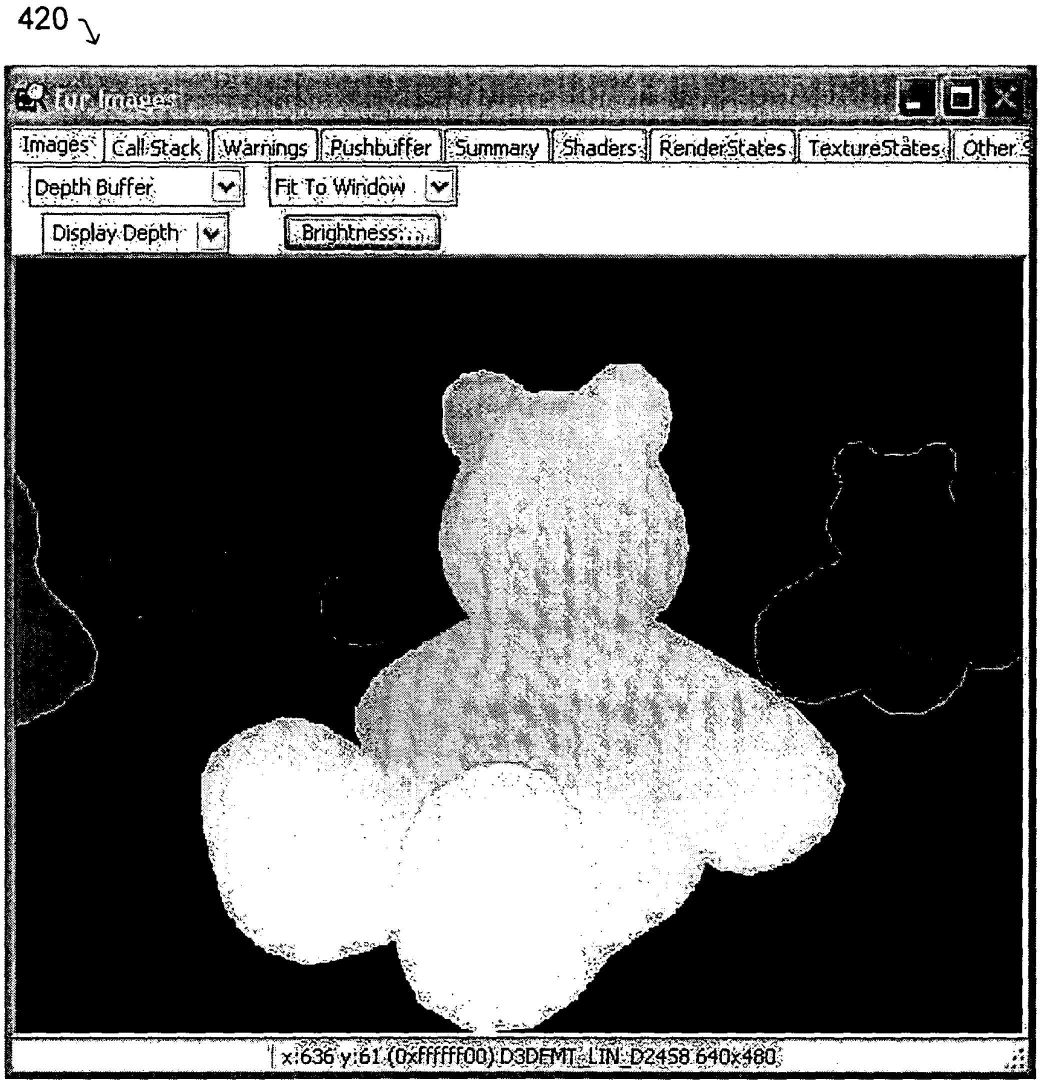
| Event | ID | CPU Start (ns) | CPU Duration (ns) | GPU Start (ns) | GPU Duration (ns) | % of Total Time | Back-end Time (ns) | Setup Time (ns) |
|---|---|---|---|---|---|---|---|---|
| KickPushBuffer | 0 | 0 | 14,449 | - | - | - | - | - |
| ⊞ FrameMove | 1 | 36,612 | 101,750 | - | 0 | - | - | - |
| Clear | 3 | 144,537 | 4,698 | 15,745,863 | 48,640 | - | - | - |
| Begin/End | 4 | 181,781 | 29,929 | 15,794,503 | 331,584 | - | - | - |
| ⊟ Bear Mesh 0 | | | | | | | | |
| DrawIndexedVertices | 6 | 252,563 | 125,782 | 16,126,087 | 278,176 | - | - | - |
| KickPushBuffer | 7 | 339,091 | 5,501 | - | - | - | - | - |
| KickPushBuffer | 8 | 374,790 | 3,385 | - | - | - | - | - |
| DrawIndexedVertices | 9 | 386,209 | 10,399 | 16,404,263 | 3,072 | - | - | - |
| DrawIndexedVertices | 10 | 401,332 | 6,393 | 16,407,335 | 2,656 | - | - | - |
| ⊞ Bear Mesh 1 | 11 | 409,555 | 56,960 | 16,409,991 | 45,568 | - | - | - |
| ⊞ Bear Mesh 2 | 15 | 466,773 | 39,522 | 16,455,559 | 74,208 | - | - | - |
| ⊞ Bear Mesh 3 | 19 | 506,536 | 91,996 | 16,529,767 | 59,072 | - | - | - |
| ⊞ Bear Mesh 4 | 25 | 598,778 | 53,437 | 16,588,839 | 47,232 | - | - | - |
| ⊞ Bear Mesh 5 | 29 | 652,769 | 39,348 | 16,636,071 | 47,552 | - | - | - |
| ⊞ Bear Mesh 6 | 33 | 692,356 | 37,207 | 16,683,623 | 45,248 | - | - | - |
| ⊞ Bear Mesh 7 | 37 | 729,799 | 92,051 | 16,728,871 | 50,783 | - | - | - |
| ⊟ Bear Fur 7 | | | | | | | | |
| ⊞ DrawFins | 44 | 852,610 | 122,595 | 16,779,656 | 156,932 | - | - | - |
| ⊞ DrawShells | 73 | 975,455 | 40,536 | 16,936,616 | 61,407 | - | - | - |
| ⊞ Bear Fur 6 | 75 | 1,019,798 | 117,933 | 16,998,024 | 219,011 | - | - | - |
| ⊞ Bear Fur 5 | 107 | 1,138,001 | 7,341,552 | 17,217,064 | 224,739 | - | - | - |
| ⊞ Bear Fur 4 | 142 | 8,479,990 | 164,020 | 17,441,832 | 284,642 | - | - | - |

*Fig. 9*



```
x:317 y:20 (0xff1c1c1d) D3DFMT_LIN_A8R8G8B8 640x480
```

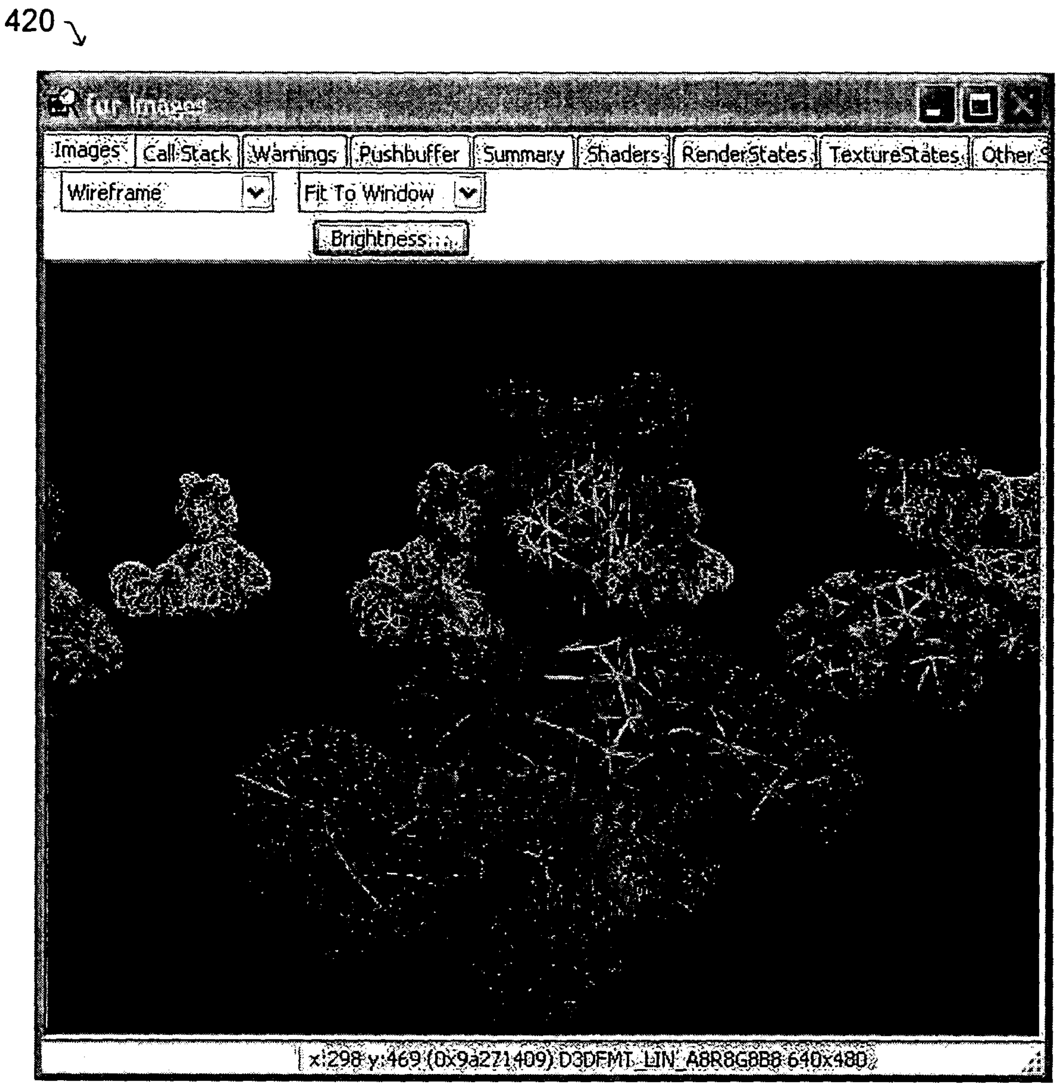
*Fig. 10*



Depth Buffer | Fit To Window
Display Depth

```
x:636 y:61 (0xffffff00) D3DFMT_LIN_D24S8 640x480
```

*Fig. 11*



```
x:298 y:469 (0x9a271409) D3DFMT_LIN_A8R8G8B8 640x480
```

*Fig. 12*

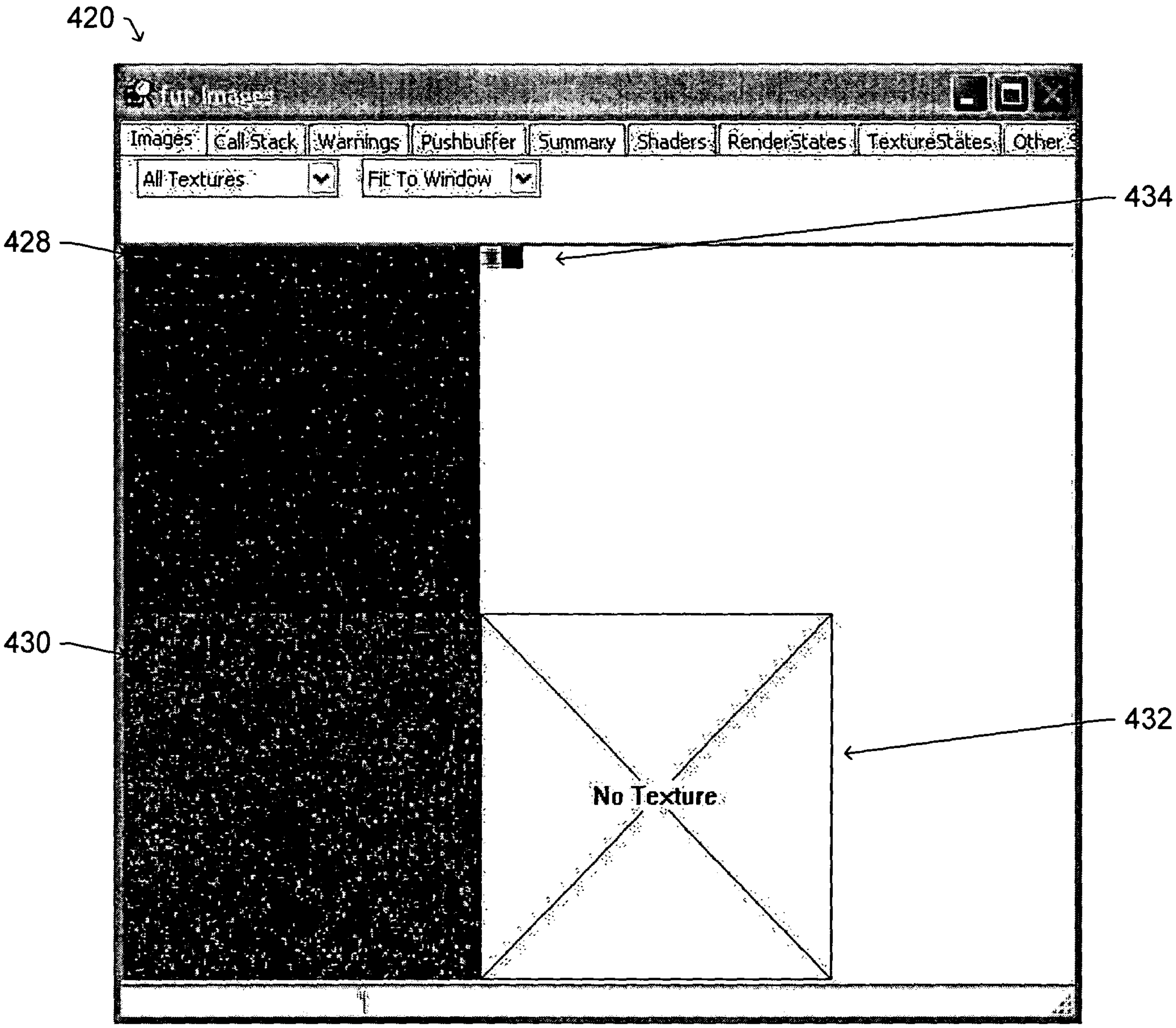
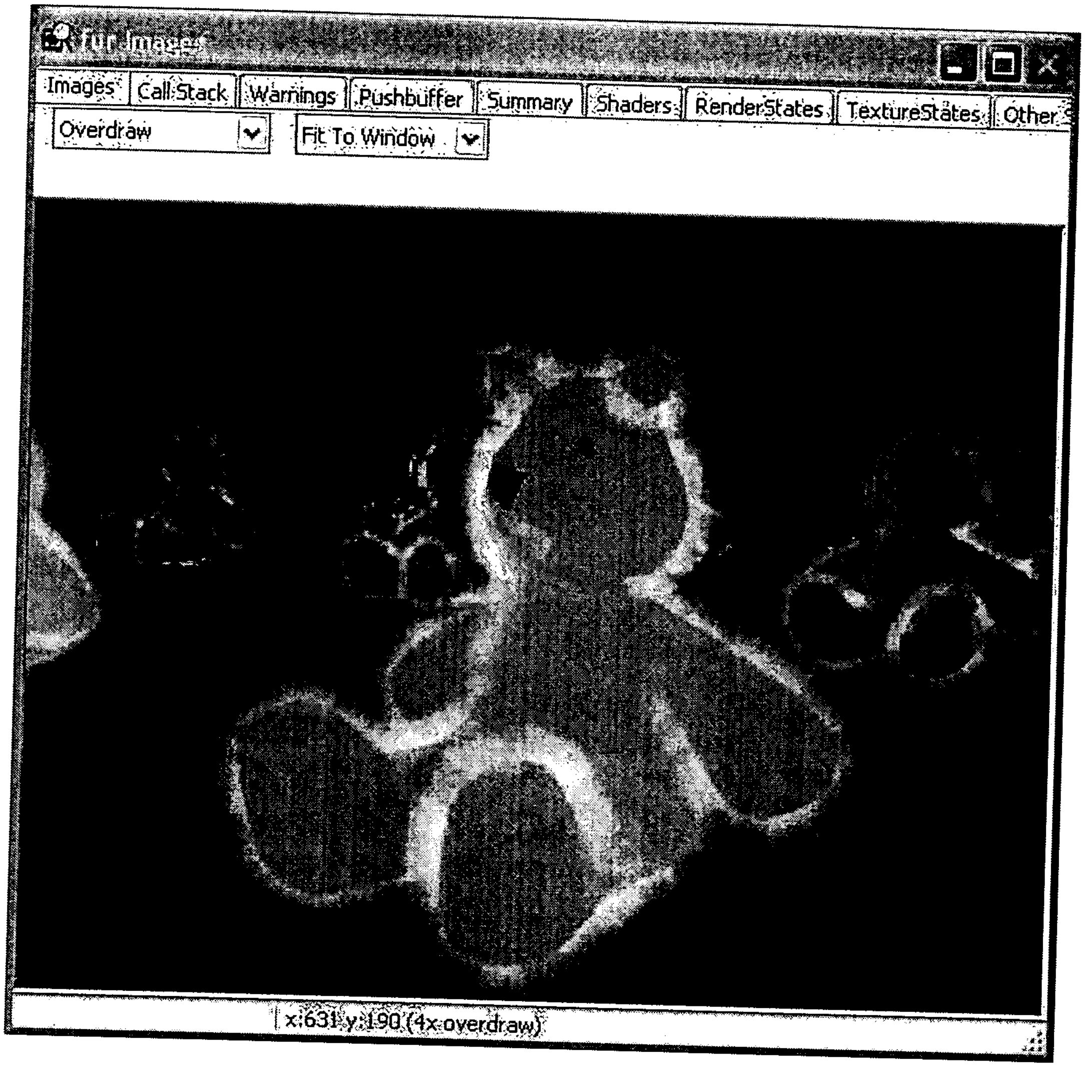

420
Fur Images
Images
Call Stack
Warnings
Pushbuffer
Summary
Shaders
RenderStates
TextureStates
Other S
All Textures
Fit To Window
434
428
430
432
No Texture

*Fig. 13*

Docket No.: MS1-1671US
Inventor(s): Kyle R. Johns and J. Andrew Goossen
Title: Facilitating Performance Analysis for Processing

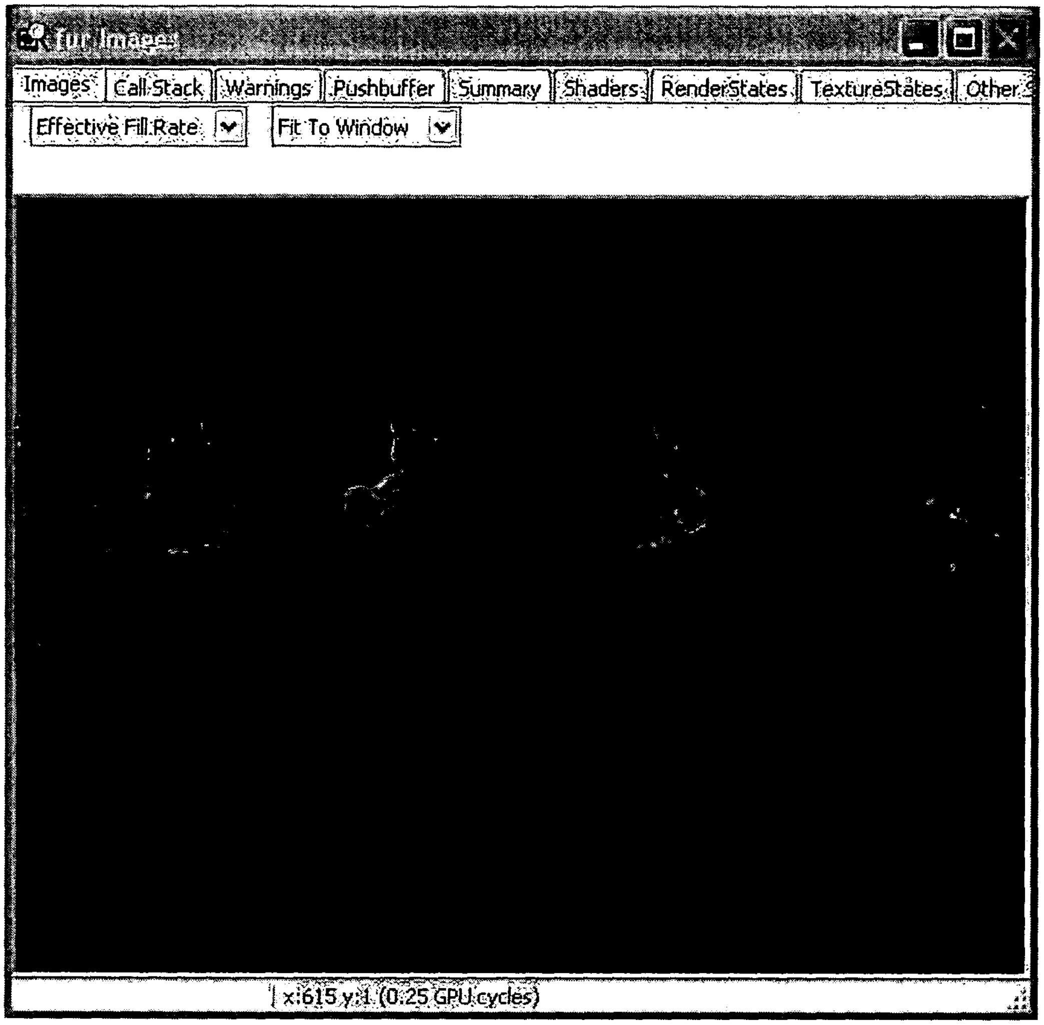
420



x:631 y:190 (4x overdraw)

*Fig. 14*

420

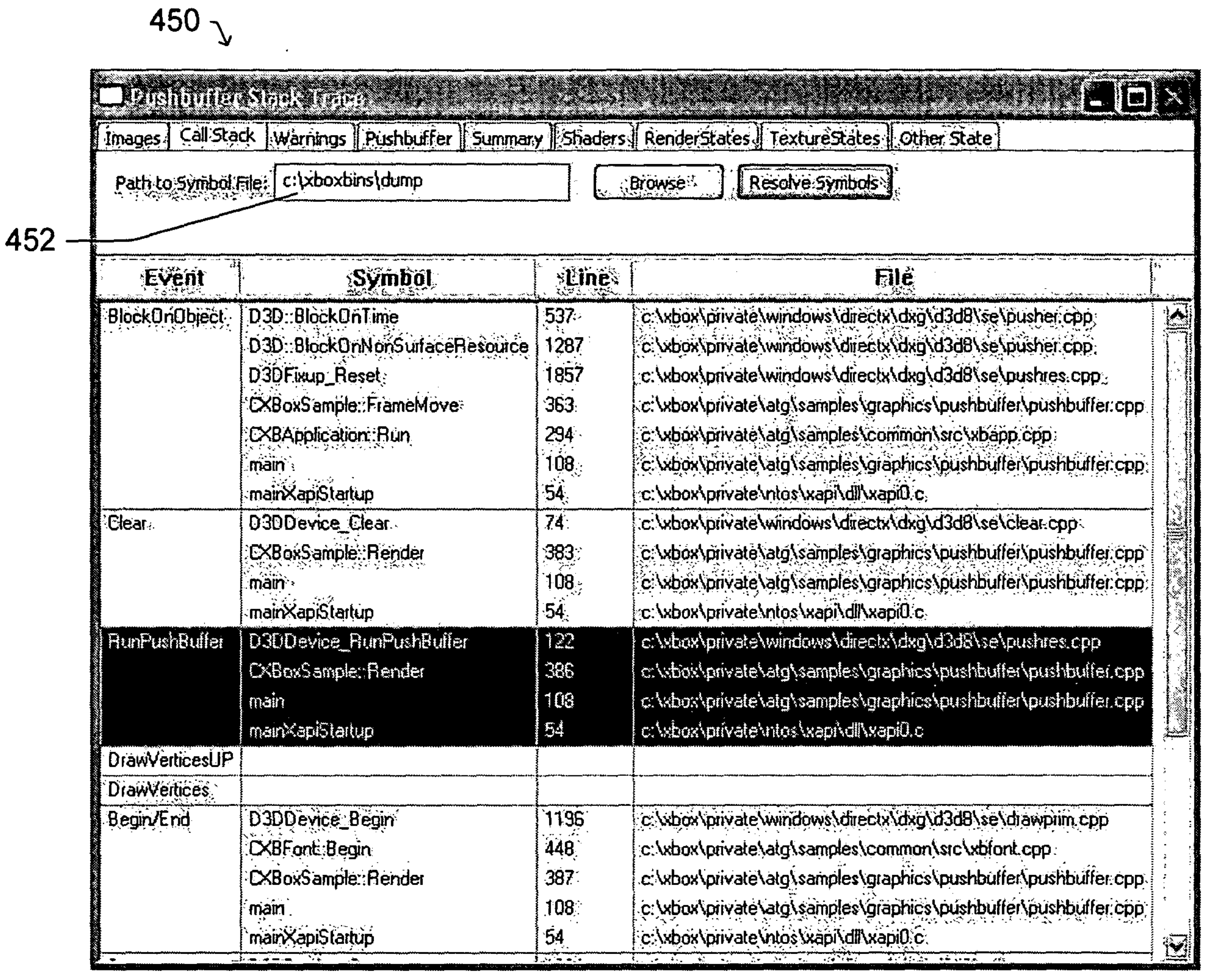


Effective Fill Rate

Fit To Window

x:615 y:1 (0.25 GPU cycles)

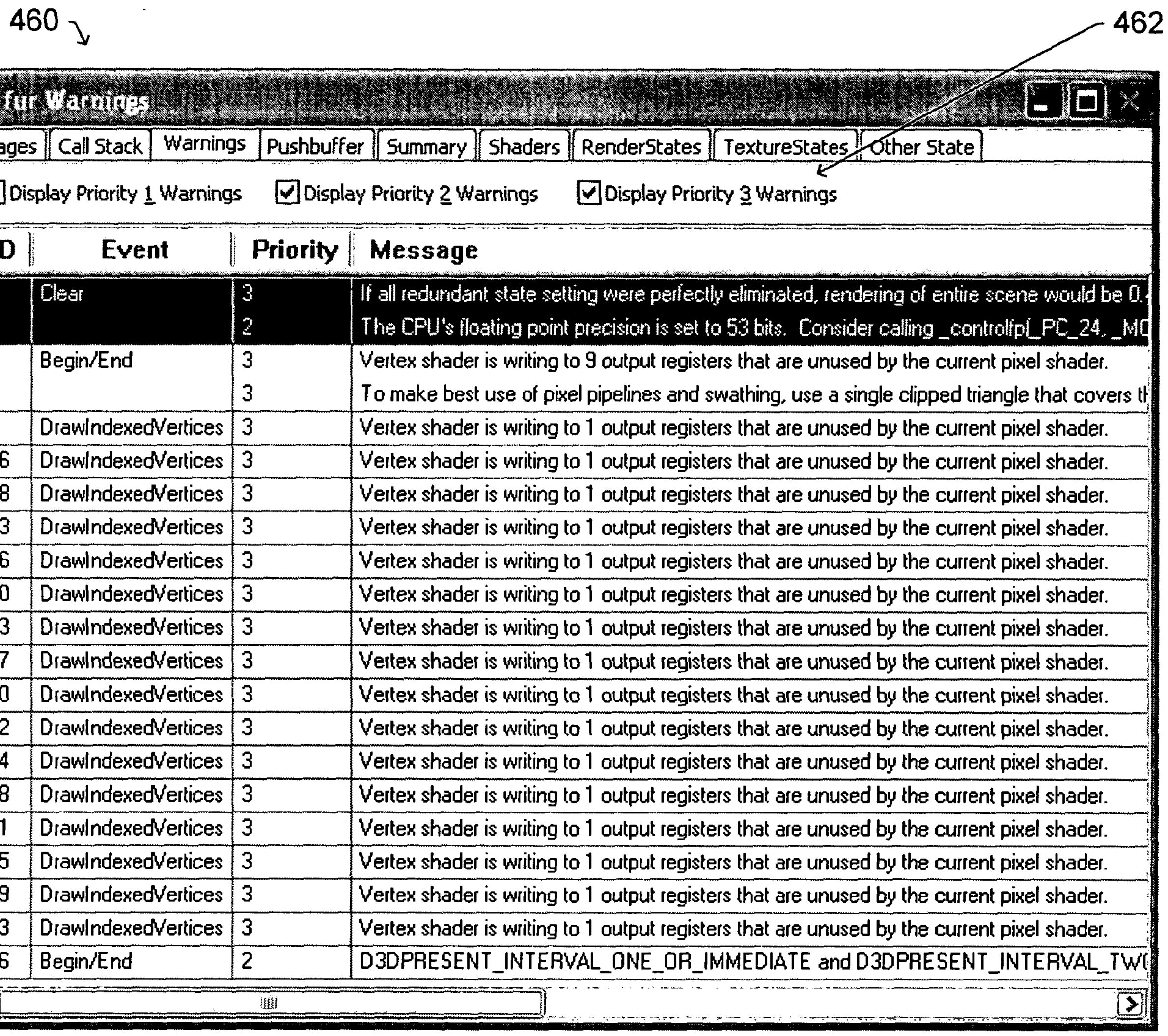
Fig. 15



Path to Symbol File: c:\xboxbins\dump

| Event | Symbol | Line | File |
|---|---|---|---|
| BlockOnObject | D3D::BlockOnTime | 537 | c:\xbox\private\windows\directx\dxg\d3d8\se\pusher.cpp |
| | D3D::BlockOnNonSurfaceResource | 1287 | c:\xbox\private\windows\directx\dxg\d3d8\se\pusher.cpp |
| | D3DFixup_Reset | 1857 | c:\xbox\private\windows\directx\dxg\d3d8\se\pushres.cpp |
| | CXBoxSample::FrameMove | 363 | c:\xbox\private\atg\samples\graphics\pushbuffer\pushbuffer.cpp |
| | CXBApplication::Run | 294 | c:\xbox\private\atg\samples\common\src\xbapp.cpp |
| | main | 108 | c:\xbox\private\atg\samples\graphics\pushbuffer\pushbuffer.cpp |
| | mainXapiStartup | 54 | c:\xbox\private\ntos\xapi\dll\xapi0.c |
| Clear | D3DDevice_Clear | 74 | c:\xbox\private\windows\directx\dxg\d3d8\se\clear.cpp |
| | CXBoxSample::Render | 383 | c:\xbox\private\atg\samples\graphics\pushbuffer\pushbuffer.cpp |
| | main | 108 | c:\xbox\private\atg\samples\graphics\pushbuffer\pushbuffer.cpp |
| | mainXapiStartup | 54 | c:\xbox\private\ntos\xapi\dll\xapi0.c |
| RunPushBuffer | D3DDevice_RunPushBuffer | 122 | c:\xbox\private\windows\directx\dxg\d3d8\se\pushres.cpp |
| | CXBoxSample::Render | 386 | c:\xbox\private\atg\samples\graphics\pushbuffer\pushbuffer.cpp |
| | main | 108 | c:\xbox\private\atg\samples\graphics\pushbuffer\pushbuffer.cpp |
| | mainXapiStartup | 54 | c:\xbox\private\ntos\xapi\dll\xapi0.c |
| DrawVerticesUP | | | |
| DrawVertices | | | |
| Begin/End | D3DDevice_Begin | 1196 | c:\xbox\private\windows\directx\dxg\d3d8\se\drawprim.cpp |
| | CXBFont::Begin | 448 | c:\xbox\private\atg\samples\common\src\xbfont.cpp |
| | CXBoxSample::Render | 387 | c:\xbox\private\atg\samples\graphics\pushbuffer\pushbuffer.cpp |
| | main | 108 | c:\xbox\private\atg\samples\graphics\pushbuffer\pushbuffer.cpp |
| | mainXapiStartup | 54 | c:\xbox\private\ntos\xapi\dll\xapi0.c |

*Fig. 16*

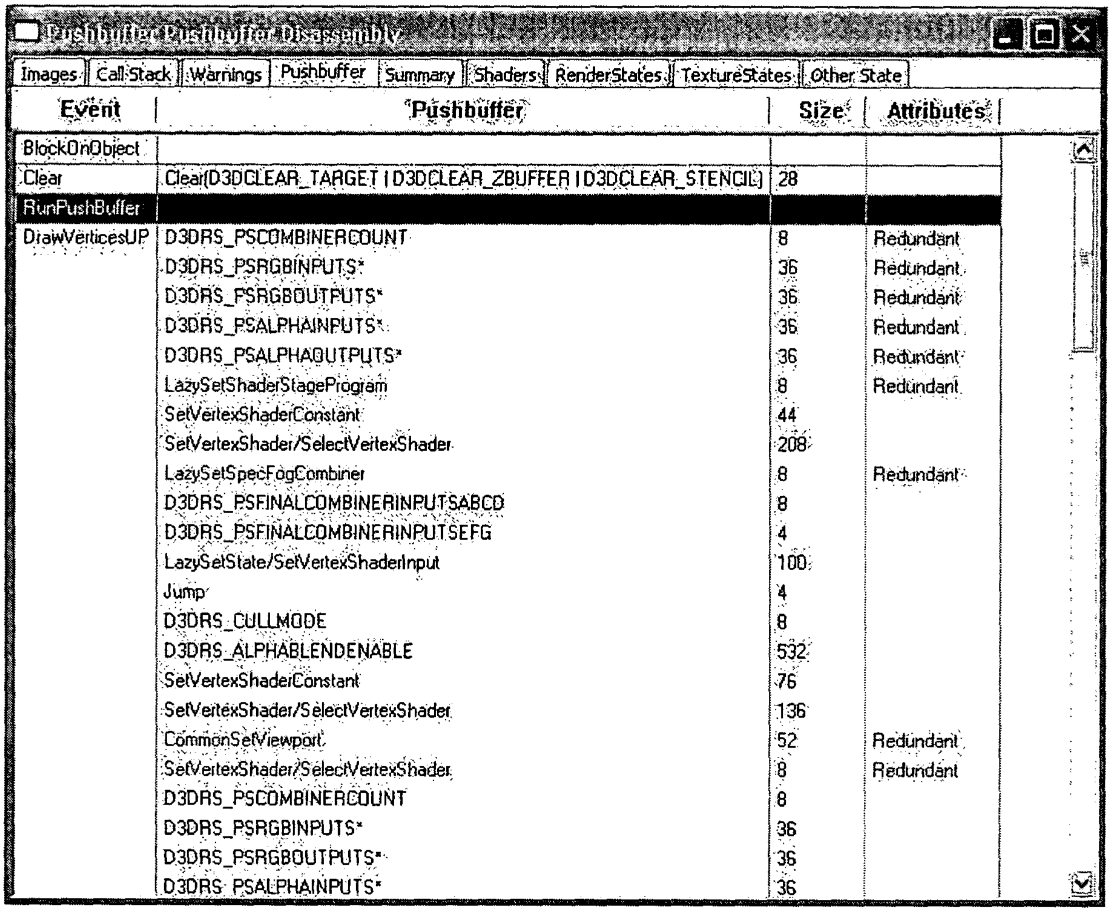


☑ Display Priority 1 Warnings ☑ Display Priority 2 Warnings ☑ Display Priority 3 Warnings

| ID | Event | Priority | Message |
|---|---|---|---|
| 3 | Clear | 3 | If all redundant state setting were perfectly eliminated, rendering of entire scene would be 0. |
| | | 2 | The CPU's floating point precision is set to 53 bits. Consider calling _controlfp(_PC_24, _MC |
| 4 | Begin/End | 3 | Vertex shader is writing to 9 output registers that are unused by the current pixel shader. |
| | | 3 | To make best use of pixel pipelines and swathing, use a single clipped triangle that covers t |
| 74 | DrawIndexedVertices | 3 | Vertex shader is writing to 1 output registers that are unused by the current pixel shader. |
| 106 | DrawIndexedVertices | 3 | Vertex shader is writing to 1 output registers that are unused by the current pixel shader. |
| 138 | DrawIndexedVertices | 3 | Vertex shader is writing to 1 output registers that are unused by the current pixel shader. |
| 173 | DrawIndexedVertices | 3 | Vertex shader is writing to 1 output registers that are unused by the current pixel shader. |
| 206 | DrawIndexedVertices | 3 | Vertex shader is writing to 1 output registers that are unused by the current pixel shader. |
| 210 | DrawIndexedVertices | 3 | Vertex shader is writing to 1 output registers that are unused by the current pixel shader. |
| 243 | DrawIndexedVertices | 3 | Vertex shader is writing to 1 output registers that are unused by the current pixel shader. |
| 247 | DrawIndexedVertices | 3 | Vertex shader is writing to 1 output registers that are unused by the current pixel shader. |
| 280 | DrawIndexedVertices | 3 | Vertex shader is writing to 1 output registers that are unused by the current pixel shader. |
| 282 | DrawIndexedVertices | 3 | Vertex shader is writing to 1 output registers that are unused by the current pixel shader. |
| 284 | DrawIndexedVertices | 3 | Vertex shader is writing to 1 output registers that are unused by the current pixel shader. |
| 288 | DrawIndexedVertices | 3 | Vertex shader is writing to 1 output registers that are unused by the current pixel shader. |
| 321 | DrawIndexedVertices | 3 | Vertex shader is writing to 1 output registers that are unused by the current pixel shader. |
| 325 | DrawIndexedVertices | 3 | Vertex shader is writing to 1 output registers that are unused by the current pixel shader. |
| 329 | DrawIndexedVertices | 3 | Vertex shader is writing to 1 output registers that are unused by the current pixel shader. |
| 333 | DrawIndexedVertices | 3 | Vertex shader is writing to 1 output registers that are unused by the current pixel shader. |
| 336 | Begin/End | 2 | D3DPRESENT_INTERVAL_ONE_OR_IMMEDIATE and D3DPRESENT_INTERVAL_TW |

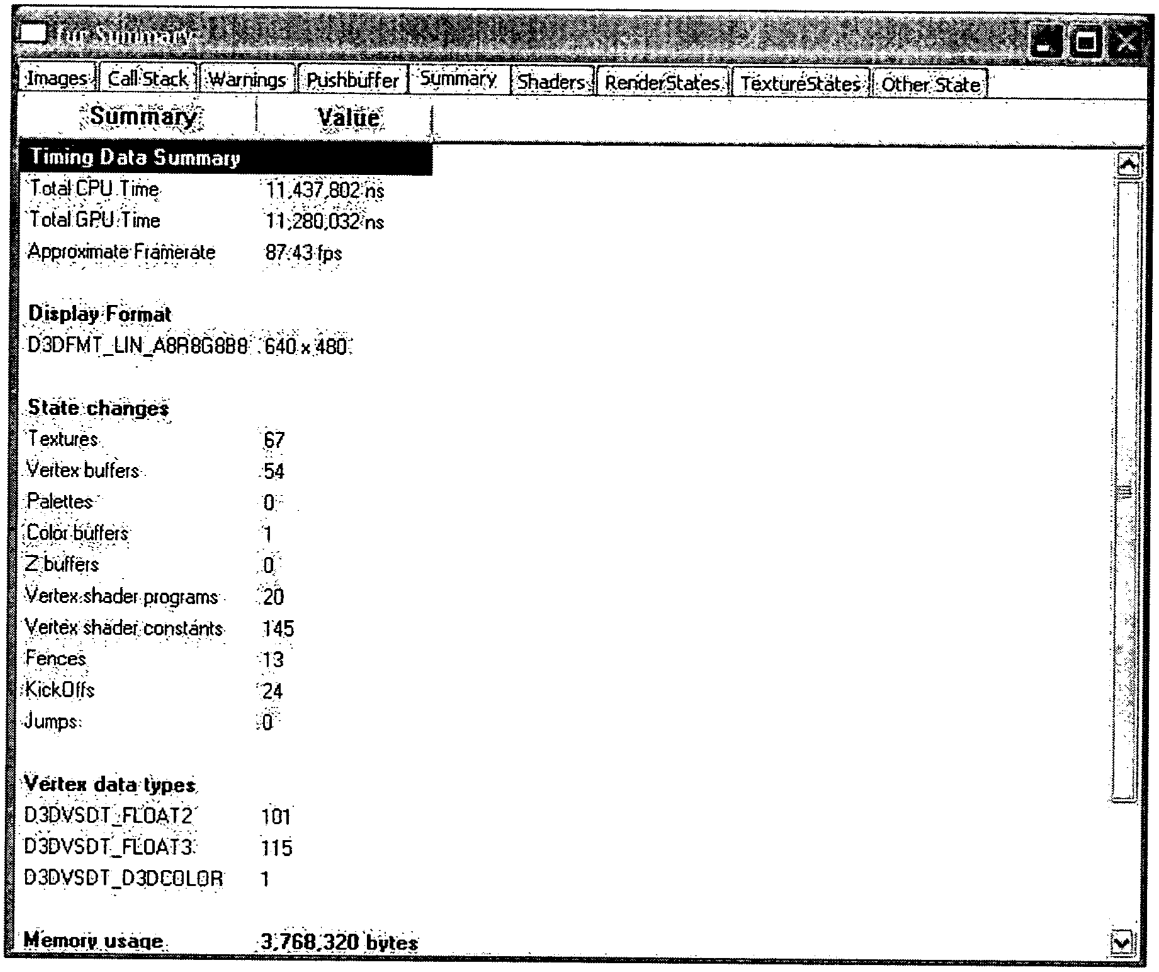
*Fig. 17*

Docket No.: MS1-1671US
Inventor(s): Kyle R. Johns and J. Andrew Goossen
Title: Facilitating Performance Analysis for Processing



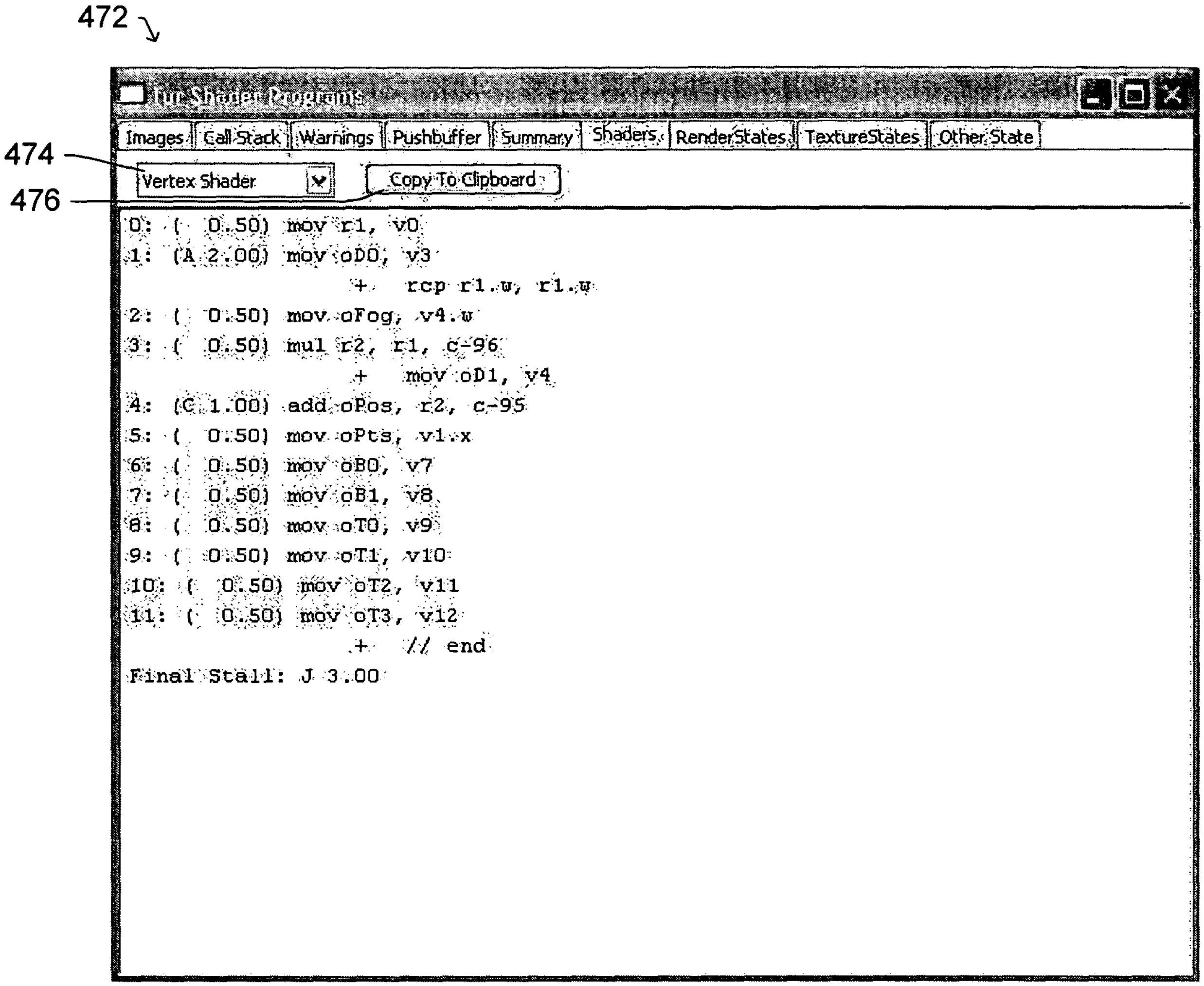
| Event | Pushbuffer | Size | Attributes |
|---|---|---|---|
| BlockOnObject | | | |
| Clear | Clear(D3DCLEAR_TARGET \| D3DCLEAR_ZBUFFER \| D3DCLEAR_STENCIL) | 28 | |
| RunPushBuffer | | | |
| DrawVerticesUP | D3DRS_PSCOMBINERCOUNT | 8 | Redundant |
| | D3DRS_PSRGBINPUTS* | 36 | Redundant |
| | D3DRS_PSRGBOUTPUTS* | 36 | Redundant |
| | D3DRS_PSALPHAINPUTS* | 36 | Redundant |
| | D3DRS_PSALPHAOUTPUTS* | 36 | Redundant |
| | LazySetShaderStageProgram | 8 | Redundant |
| | SetVertexShaderConstant | 44 | |
| | SetVertexShader/SelectVertexShader | 208 | |
| | LazySetSpecFogCombiner | 8 | Redundant |
| | D3DRS_PSFINALCOMBINERINPUTSABCD | 8 | |
| | D3DRS_PSFINALCOMBINERINPUTSEFG | 4 | |
| | LazySetState/SetVertexShaderInput | 100 | |
| | Jump | 4 | |
| | D3DRS_CULLMODE | 8 | |
| | D3DRS_ALPHABLENDENABLE | 532 | |
| | SetVertexShaderConstant | 76 | |
| | SetVertexShader/SelectVertexShader | 136 | |
| | CommonSetViewport | 52 | Redundant |
| | SetVertexShader/SelectVertexShader | 8 | Redundant |
| | D3DRS_PSCOMBINERCOUNT | 8 | |
| | D3DRS_PSRGBINPUTS* | 36 | |
| | D3DRS_PSRGBOUTPUTS* | 36 | |
| | D3DRS_PSALPHAINPUTS* | 36 | |

Fig. 18



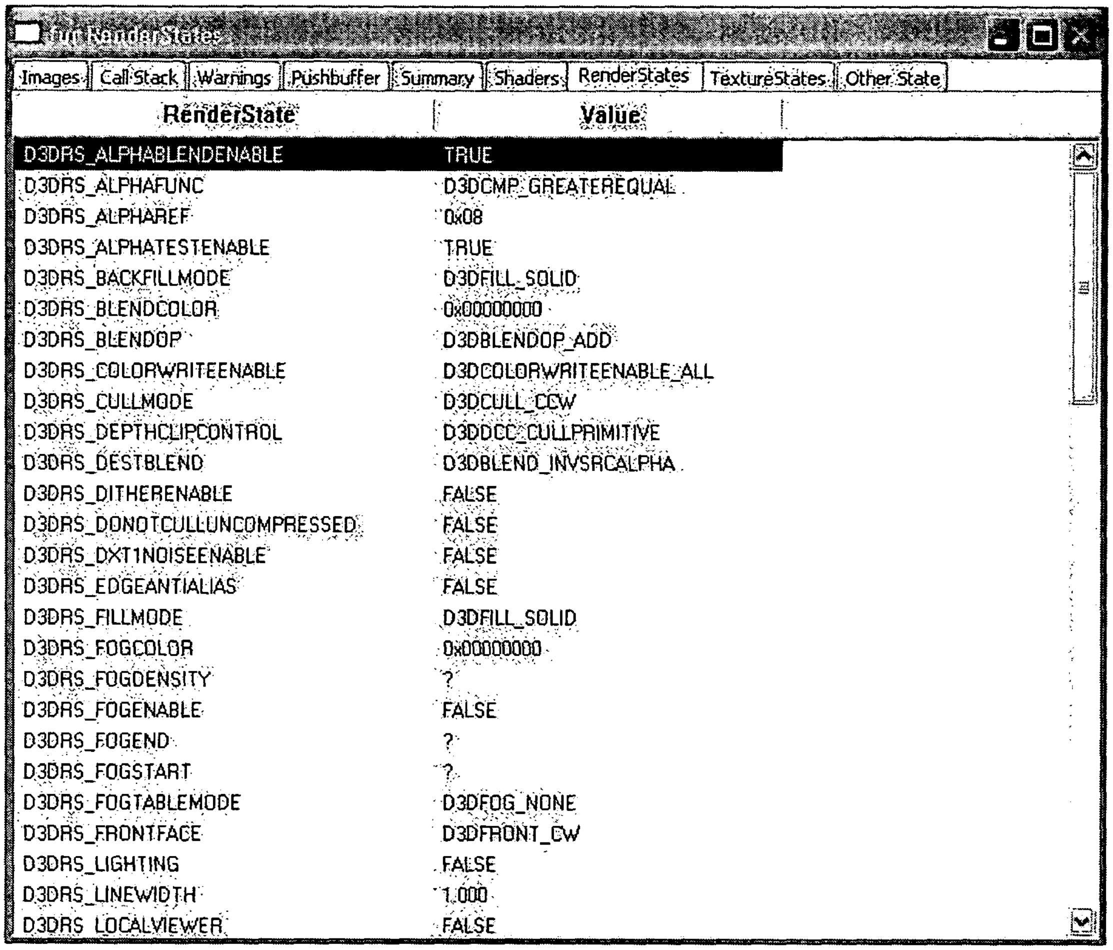
| Summary | Value |
|---|---|
| **Timing Data Summary** | |
| Total CPU Time | 11,437,802 ns |
| Total GPU Time | 11,280,032 ns |
| Approximate Framerate | 87.43 fps |
| | |
| **Display Format** | |
| D3DFMT_LIN_A8R8G8B8 | 640 x 480 |
| | |
| **State changes** | |
| Textures | 67 |
| Vertex buffers | 54 |
| Palettes | 0 |
| Color buffers | 1 |
| Z buffers | 0 |
| Vertex shader programs | 20 |
| Vertex shader constants | 145 |
| Fences | 13 |
| KickOffs | 24 |
| Jumps | 0 |
| | |
| **Vertex data types** | |
| D3DVSDT_FLOAT2 | 101 |
| D3DVSDT_FLOAT3 | 115 |
| D3DVSDT_D3DCOLOR | 1 |
| | |
| **Memory usage** | **3,768,320 bytes** |

*Fig. 19*



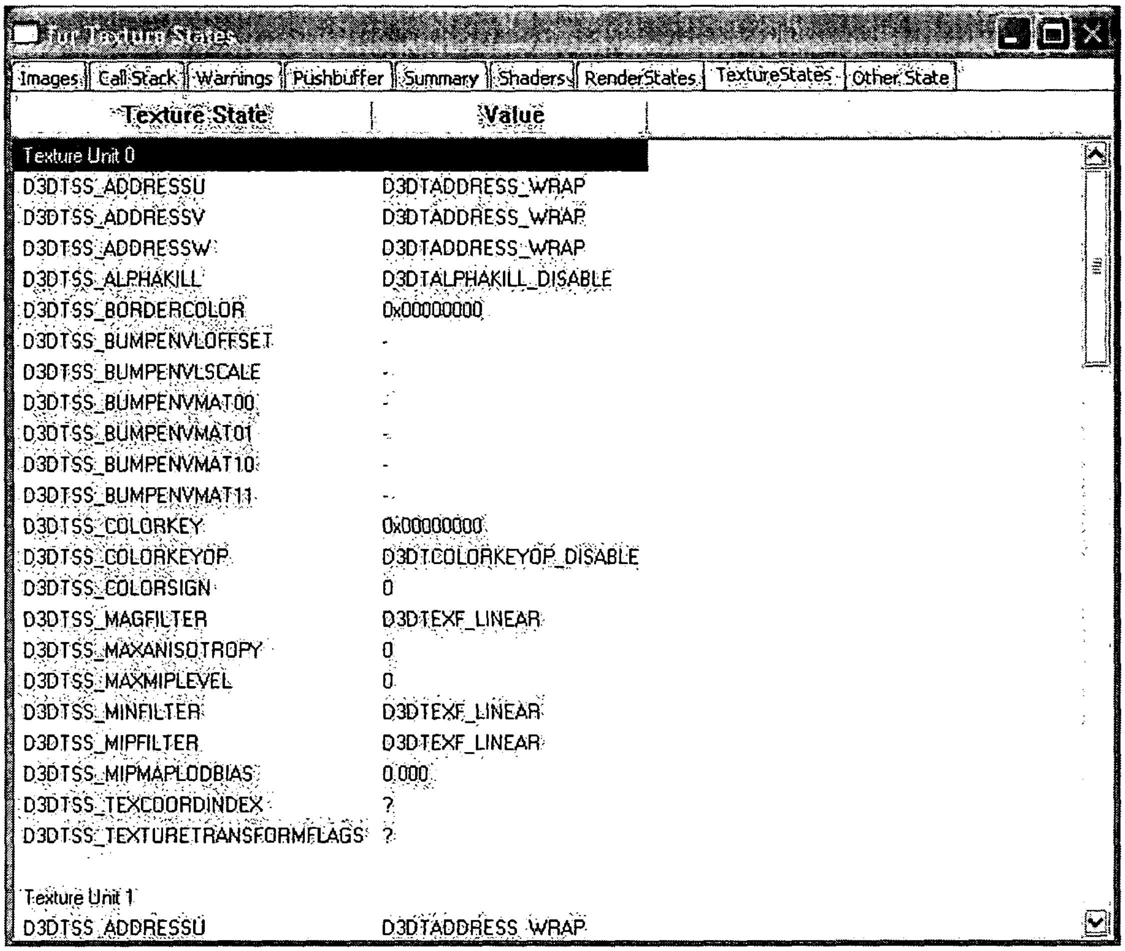
```
0: (  0.50) mov r1, v0
1: (A 2.00) mov oD0, v3
                  +   rcp r1.w, r1.w
2: (  0.50) mov oFog, v4.w
3: (  0.50) mul r2, r1, c-96
                  +   mov oD1, v4
4: (C 1.00) add oPos, r2, c-95
5: (  0.50) mov oPts, v1.x
6: (  0.50) mov oB0, v7
7: (  0.50) mov oB1, v8
8: (  0.50) mov oT0, v9
9: (  0.50) mov oT1, v10
10: (  0.50) mov oT2, v11
11: (  0.50) mov oT3, v12
                  +   // end
Final Stall: J 3.00
```

*Fig. 20*



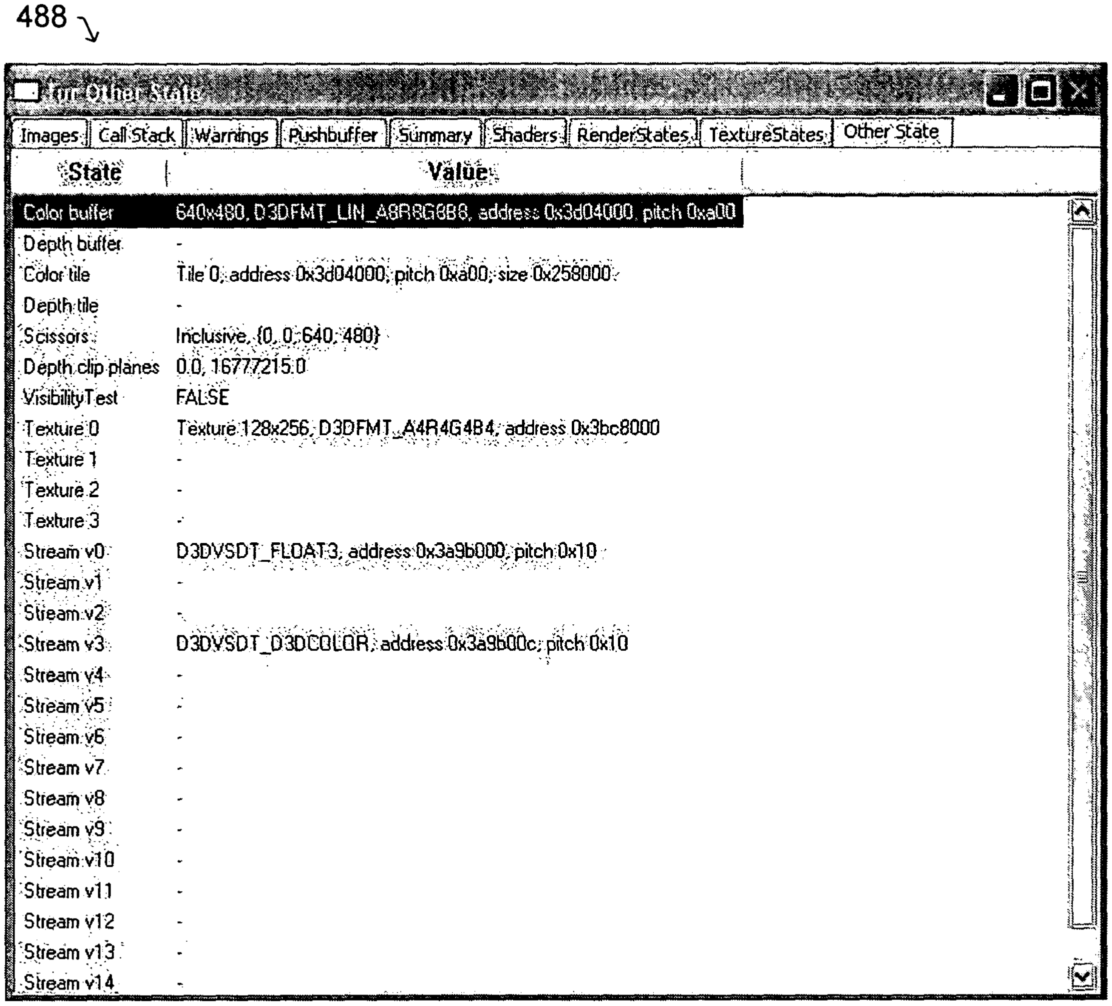
| RenderState | Value |
|---|---|
| D3DRS_ALPHABLENDENABLE | TRUE |
| D3DRS_ALPHAFUNC | D3DCMP_GREATEREQUAL |
| D3DRS_ALPHAREF | 0x08 |
| D3DRS_ALPHATESTENABLE | TRUE |
| D3DRS_BACKFILLMODE | D3DFILL_SOLID |
| D3DRS_BLENDCOLOR | 0x00000000 |
| D3DRS_BLENDOP | D3DBLENDOP_ADD |
| D3DRS_COLORWRITEENABLE | D3DCOLORWRITEENABLE_ALL |
| D3DRS_CULLMODE | D3DCULL_CCW |
| D3DRS_DEPTHCLIPCONTROL | D3DDCC_CULLPRIMITIVE |
| D3DRS_DESTBLEND | D3DBLEND_INVSRCALPHA |
| D3DRS_DITHERENABLE | FALSE |
| D3DRS_DONOTCULLUNCOMPRESSED | FALSE |
| D3DRS_DXT1NOISEENABLE | FALSE |
| D3DRS_EDGEANTIALIAS | FALSE |
| D3DRS_FILLMODE | D3DFILL_SOLID |
| D3DRS_FOGCOLOR | 0x00000000 |
| D3DRS_FOGDENSITY | ? |
| D3DRS_FOGENABLE | FALSE |
| D3DRS_FOGEND | ? |
| D3DRS_FOGSTART | ? |
| D3DRS_FOGTABLEMODE | D3DFOG_NONE |
| D3DRS_FRONTFACE | D3DFRONT_CW |
| D3DRS_LIGHTING | FALSE |
| D3DRS_LINEWIDTH | 1.000 |
| D3DRS_LOCALVIEWER | FALSE |

Fig. 21



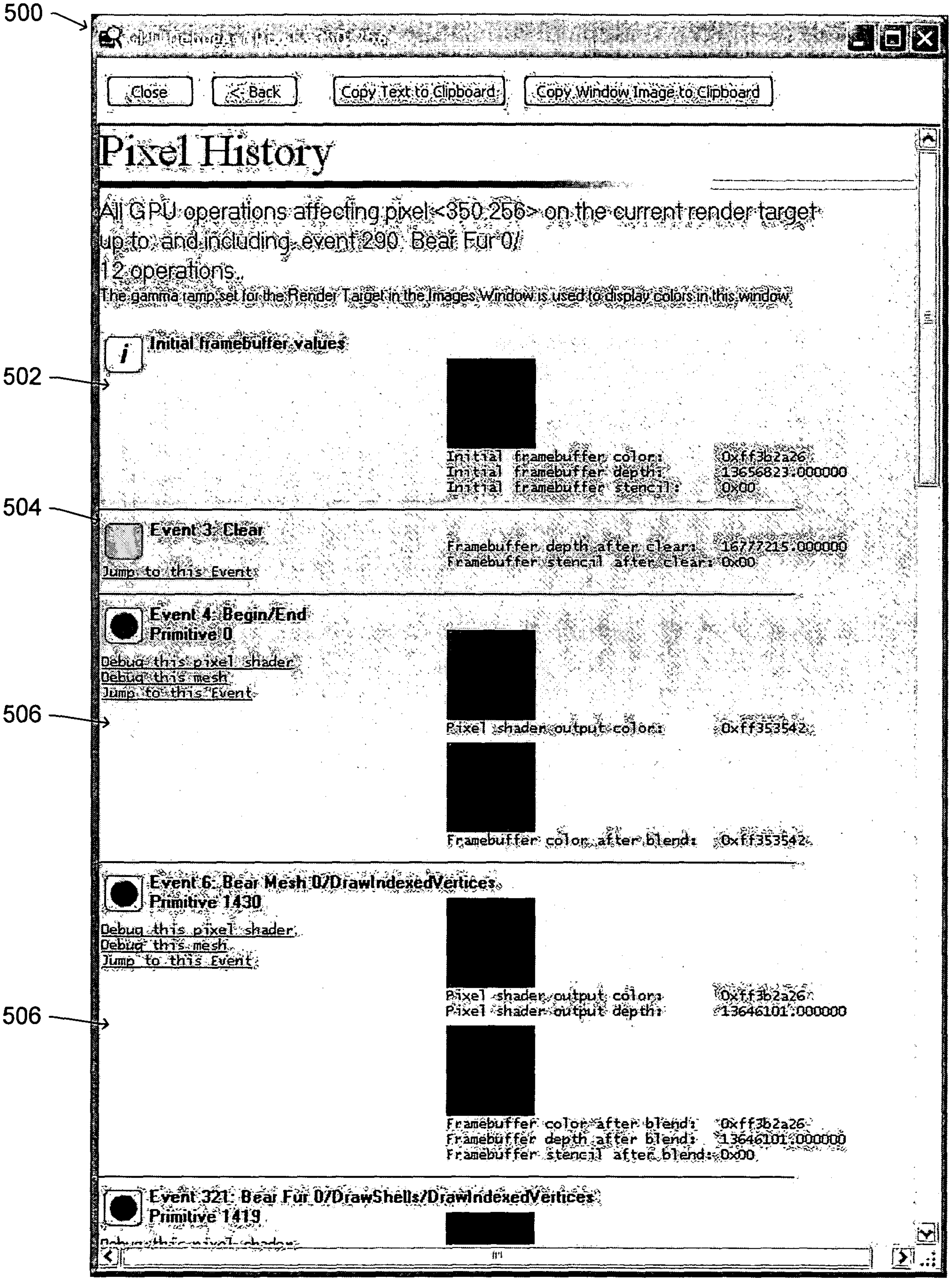
| Texture State | Value |
|---|---|
| Texture Unit 0 | |
| D3DTSS_ADDRESSU | D3DTADDRESS_WRAP |
| D3DTSS_ADDRESSV | D3DTADDRESS_WRAP |
| D3DTSS_ADDRESSW | D3DTADDRESS_WRAP |
| D3DTSS_ALPHAKILL | D3DTALPHAKILL_DISABLE |
| D3DTSS_BORDERCOLOR | 0x00000000 |
| D3DTSS_BUMPENVLOFFSET | - |
| D3DTSS_BUMPENVLSCALE | - |
| D3DTSS_BUMPENVMAT00 | - |
| D3DTSS_BUMPENVMAT01 | - |
| D3DTSS_BUMPENVMAT10 | - |
| D3DTSS_BUMPENVMAT11 | - |
| D3DTSS_COLORKEY | 0x00000000 |
| D3DTSS_COLORKEYOP | D3DTCOLORKEYOP_DISABLE |
| D3DTSS_COLORSIGN | 0 |
| D3DTSS_MAGFILTER | D3DTEXF_LINEAR |
| D3DTSS_MAXANISOTROPY | 0 |
| D3DTSS_MAXMIPLEVEL | 0 |
| D3DTSS_MINFILTER | D3DTEXF_LINEAR |
| D3DTSS_MIPFILTER | D3DTEXF_LINEAR |
| D3DTSS_MIPMAPLODBIAS | 0.000 |
| D3DTSS_TEXCOORDINDEX | ? |
| D3DTSS_TEXTURETRANSFORMFLAGS | ? |
| | |
| Texture Unit 1 | |
| D3DTSS_ADDRESSU | D3DTADDRESS_WRAP |

*Fig. 22*



| State | Value |
|---|---|
| Color buffer | 640x480, D3DFMT_LIN_A8R8G8B8, address 0x3d04000, pitch 0xa00 |
| Depth buffer | - |
| Color tile | Tile 0, address 0x3d04000, pitch 0xa00, size 0x258000 |
| Depth tile | - |
| Scissors | Inclusive, {0, 0, 640, 480} |
| Depth clip planes | 0.0, 16777215.0 |
| VisibilityTest | FALSE |
| Texture 0 | Texture 128x256, D3DFMT_A4R4G4B4, address 0x3bc8000 |
| Texture 1 | - |
| Texture 2 | - |
| Texture 3 | - |
| Stream v0 | D3DVSDT_FLOAT3, address 0x3a9b000, pitch 0x10 |
| Stream v1 | - |
| Stream v2 | - |
| Stream v3 | D3DVSDT_D3DCOLOR, address 0x3a9b00c, pitch 0x10 |
| Stream v4 | - |
| Stream v5 | - |
| Stream v6 | - |
| Stream v7 | - |
| Stream v8 | - |
| Stream v9 | - |
| Stream v10 | - |
| Stream v11 | - |
| Stream v12 | - |
| Stream v13 | - |
| Stream v14 | - |

Fig. 23



# Pixel History

All GPU operations affecting pixel <350,256> on the current render target up to and including event 290: Bear Fur 0/
12 operations.
The gamma ramp set for the Render Target in the Images Window is used to display colors in this window.

**Initial framebuffer values**

```
Initial framebuffer color:     0xff3b2a26
Initial framebuffer depth:     13656823.000000
Initial framebuffer stencil:   0x00
```

**Event 3: Clear**

Jump to this Event

```
Framebuffer depth after clear:   16777215.000000
Framebuffer stencil after clear: 0x00
```

**Event 4: Begin/End**
**Primitive 0**

Debug this pixel shader
Debug this mesh
Jump to this Event

```
Pixel shader output color:     0xff353542

Framebuffer color after blend: 0xff353542
```

**Event 6: Bear Mesh 0/DrawIndexedVertices**
**Primitive 1430**

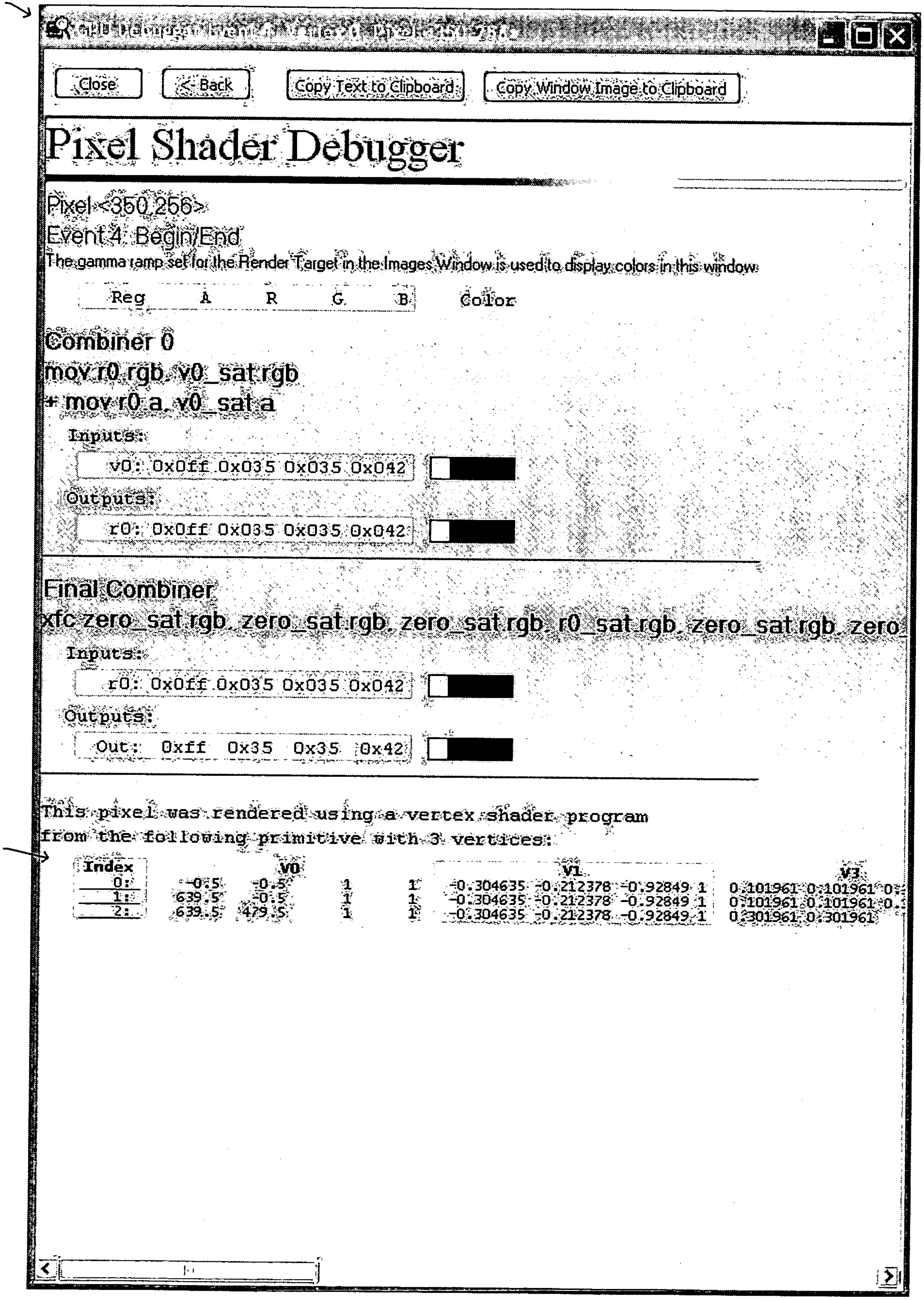
Debug this pixel shader
Debug this mesh
Jump to this Event

```
Pixel shader output color:     0xff3b2a26
Pixel shader output depth:     13646101.000000

Framebuffer color after blend:   0xff3b2a26
Framebuffer depth after blend:   13646101.000000
Framebuffer stencil after blend: 0x00
```

**Event 321: Bear Fur 0/DrawShells/DrawIndexedVertices**
**Primitive 1419**

Debug this pixel shader

*Fig. 24*



# Pixel Shader Debugger

Pixel <350,256>

Event 4: Begin/End

The gamma ramp set for the Render Target in the Images Window is used to display colors in this window

| Reg | A | R | G | B | Color |
|---|---|---|---|---|---|

## Combiner 0

mov r0.rgb, v0_sat.rgb
+ mov r0.a, v0_sat.a

Inputs:

| | | | | | |
|---|---|---|---|---|---|
| v0: | 0x0ff | 0x035 | 0x035 | 0x042 | ■ |

Outputs:

| | | | | | |
|---|---|---|---|---|---|
| r0: | 0x0ff | 0x035 | 0x035 | 0x042 | ■ |

## Final Combiner

xfc zero_sat.rgb, zero_sat.rgb, zero_sat.rgb, r0_sat.rgb, zero_sat.rgb, zero

Inputs:

| | | | | | |
|---|---|---|---|---|---|
| r0: | 0x0ff | 0x035 | 0x035 | 0x042 | ■ |

Outputs:

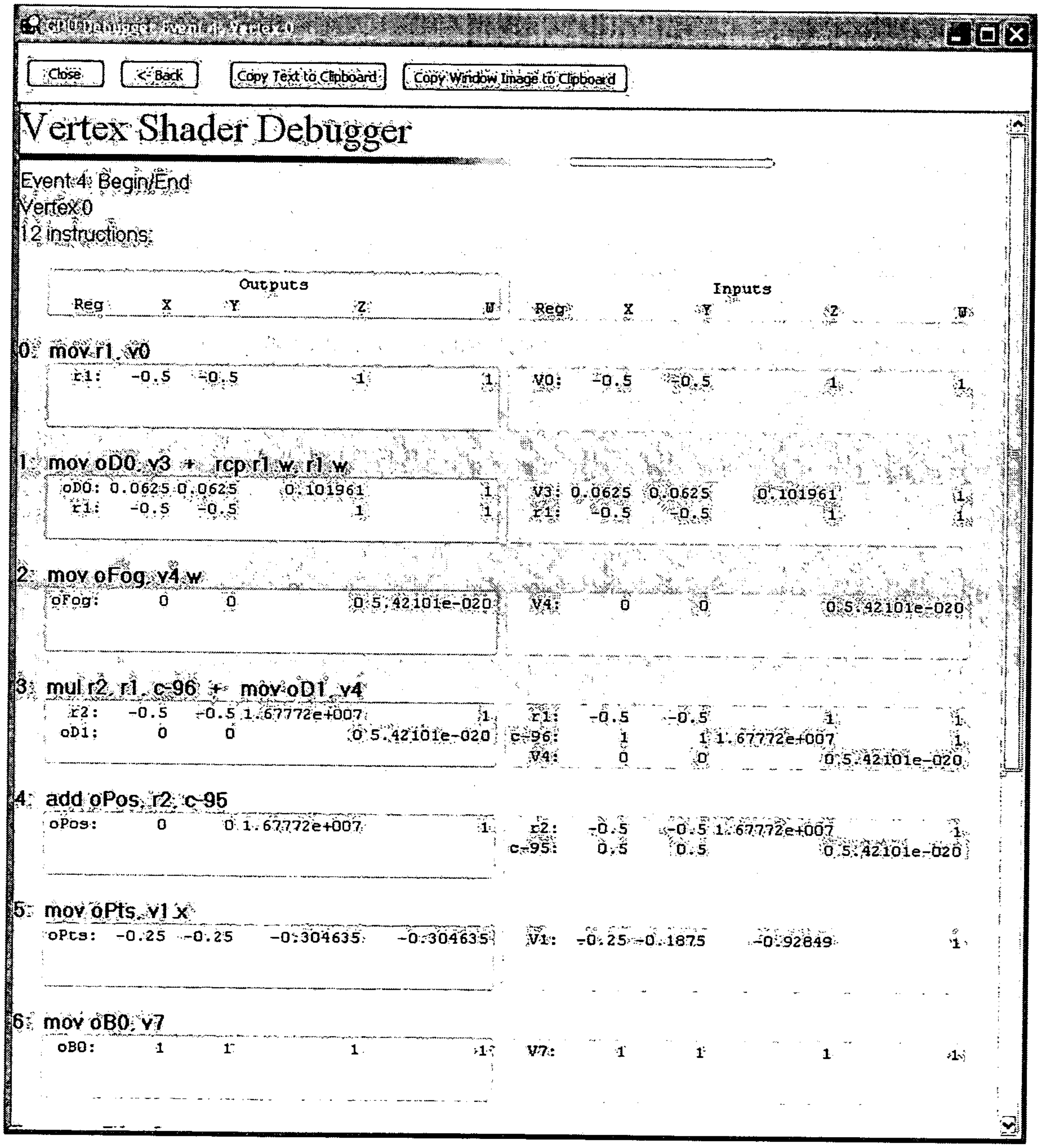
| | | | | | |
|---|---|---|---|---|---|
| Out: | 0xff | 0x35 | 0x35 | 0x42 | ■ |

This pixel was rendered using a vertex shader program from the following primitive with 3 vertices:

| Index | V0 | | | | V1 | | | | V3 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0: | -0.5 | -0.5 | 1 | 1 | -0.304635 | -0.212378 | -0.92849 | 1 | 0.101961 | 0.101961 | 0. |
| 1: | 639.5 | -0.5 | 1 | 1 | -0.304635 | -0.212378 | -0.92849 | 1 | 0.101961 | 0.101961 | 0. |
| 2: | 639.5 | 479.5 | 1 | 1 | -0.304635 | -0.212378 | -0.92849 | 1 | 0.301961 | 0.301961 | |

*Fig. 25*

540

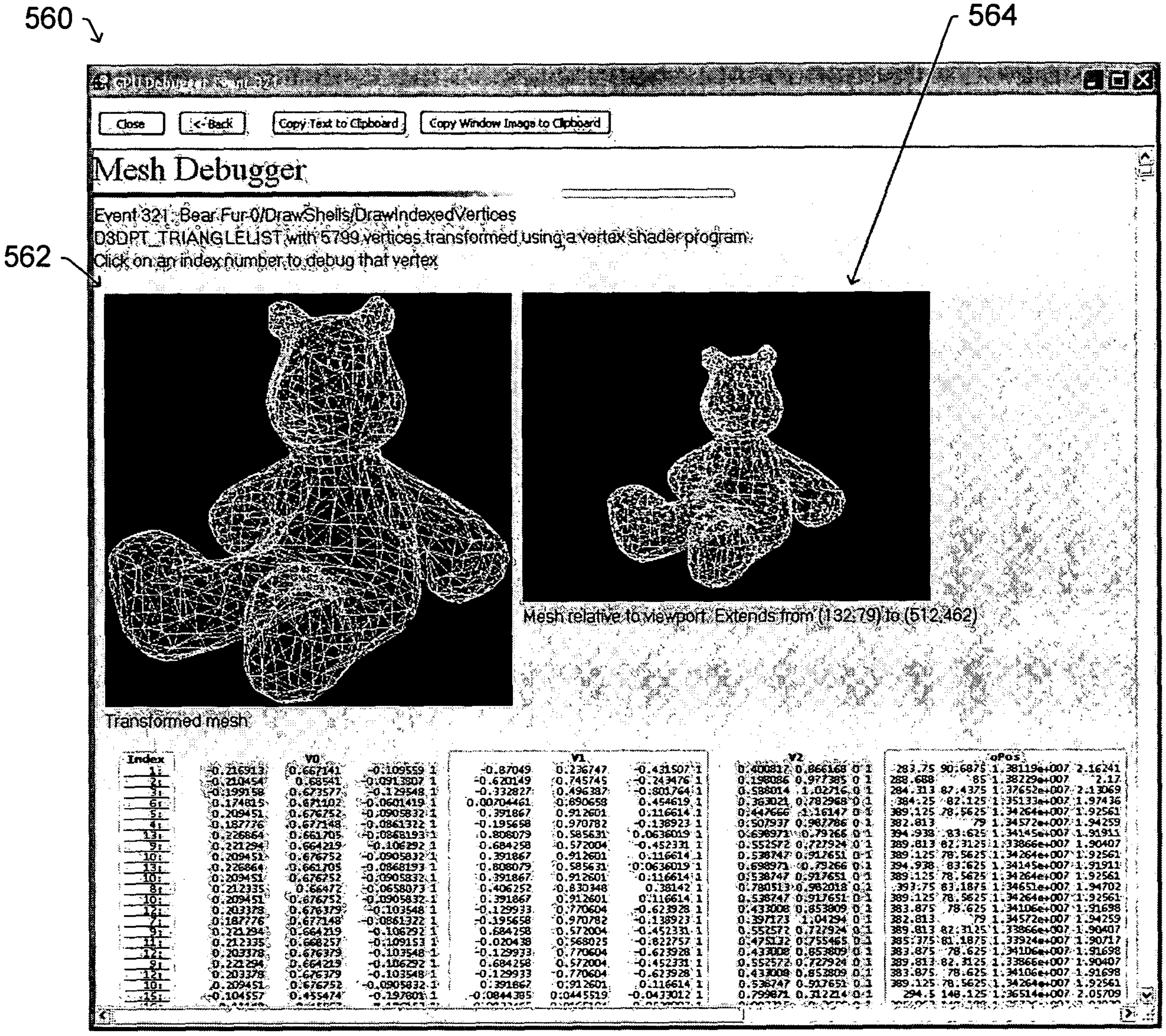

GPU Debugger: Event 4, Vertex 0
Close
<- Back
Copy Text to Clipboard
Copy Window Image to Clipboard

## Vertex Shader Debugger

Event 4: Begin/End
Vertex 0
12 instructions:

```
                  Outputs                                        Inputs
   Reg      X      Y               Z              W    Reg     X       Y                Z               W

0: mov r1, v0
   r1:   -0.5   -0.5               1              1    V0:   -0.5    -0.5               1               1

1: mov oD0, v3  +  rcp r1.w, r1.w
   oD0: 0.0625 0.0625        0.101961             1    V3: 0.0625  0.0625        0.101961               1
   r1:   -0.5   -0.5               1              1    r1:   -0.5    -0.5               1               1

2: mov oFog, v4.w
   oFog:    0      0             0 5.42101e-020        V4:      0       0             0 5.42101e-020

3: mul r2, r1, c-96  +  mov oD1, v4
   r2:   -0.5   -0.5 1.67772e+007                 1    r1:   -0.5    -0.5               1               1
   oD1:     0      0             0 5.42101e-020      c-96:      1       1 1.67772e+007                   1
                                                       V4:      0       0             0 5.42101e-020

4: add oPos, r2, c-95
   oPos:    0      0 1.67772e+007                 1    r2:   -0.5    -0.5 1.67772e+007                   1
                                                     c-95:    0.5     0.5             0 5.42101e-020

5: mov oPts, v1.x
   oPts: -0.25  -0.25      -0.304635      -0.304635    V1:  -0.25 -0.1875        -0.92849               1

6: mov oB0, v7
   oB0:     1      1               1              1    V7:      1       1               1               1
```

*Fig. 26*



# Mesh Debugger

Event 321 : Bear Fur-0/DrawShells/DrawIndexedVertices
D3DPT_TRIANGLELIST with 5799 vertices transformed using a vertex shader program.
Click on an index number to debug that vertex

Mesh relative to viewport. Extends from (132,79) to (512,462)

Transformed mesh

| Index | V0 | V1 | V2 | oPos |
|---|---|---|---|---|
| 1: | -0.216913 0.667141 -0.109559 1 | -0.87049 0.236747 -0.431507 1 | 0.400817 0.866168 0 1 | 283.75 90.6875 1.38119e+007 2.16241 |
| 2: | -0.210454 0.68541 -0.0913807 1 | -0.620149 0.745745 -0.243476 1 | 0.198086 0.977385 0 1 | 288.688 85 1.38229e+007 2.17 |
| 3: | -0.199158 0.673577 -0.129548 1 | -0.332827 0.496387 -0.801764 1 | 0.588014 1.02716 0 1 | 284.313 87.4375 1.37652e+007 2.13069 |
| 6: | 0.174815 0.671102 -0.0601419 1 | 0.00704461 0.690659 0.454619 1 | 0.363021 0.782968 0 1 | 384.25 82.125 1.35133e+007 1.97436 |
| 5: | 0.209451 0.676752 -0.0905832 1 | 0.391867 0.912601 0.116614 1 | 0.447666 1.16147 0 1 | 389.125 78.5625 1.34264e+007 1.92561 |
| 4: | 0.187776 0.677148 -0.0861322 1 | -0.195658 0.970782 -0.138923 1 | 0.507937 0.987786 0 1 | 382.813 79 1.34572e+007 1.94259 |
| 13: | 0.226864 0.661705 -0.0868193 1 | 0.808079 0.585631 0.0636019 1 | 0.698971 0.79266 0 1 | 394.938 83.625 1.34145e+007 1.91911 |
| 9: | 0.221294 0.664219 -0.106292 1 | 0.684258 0.572004 -0.452331 1 | 0.552572 0.727924 0 1 | 389.813 82.3125 1.33866e+007 1.90407 |
| 10: | 0.209451 0.676752 -0.0905832 1 | 0.391867 0.912601 0.116614 1 | 0.538747 0.917651 0 1 | 389.125 78.5625 1.34264e+007 1.92561 |
| 13: | 0.226864 0.661705 -0.0868193 1 | 0.808079 0.585631 0.0636019 1 | 0.698971 0.79266 0 1 | 394.938 83.625 1.34145e+007 1.91911 |
| 10: | 0.209451 0.676752 -0.0905832 1 | 0.391867 0.912601 0.116614 1 | 0.538747 0.917651 0 1 | 389.125 78.5625 1.34264e+007 1.92561 |
| 8: | 0.212335 0.66472 -0.0658073 1 | 0.406252 0.830348 0.38142 1 | 0.780513 0.982018 0 1 | 393.75 83.1875 1.34651e+007 1.94702 |
| 10: | 0.209451 0.676752 -0.0905832 1 | 0.391867 0.912601 0.116614 1 | 0.538747 0.917651 0 1 | 389.125 78.5625 1.34264e+007 1.92561 |
| 12: | 0.203378 0.676379 -0.103548 1 | -0.129933 0.770604 -0.623928 1 | 0.433008 0.853809 0 1 | 383.875 78.625 1.34106e+007 1.91698 |
| 7: | 0.187776 0.677148 -0.0861322 1 | -0.195658 0.970782 -0.138923 1 | 0.397173 1.04294 0 1 | 382.813 79 1.34572e+007 1.94259 |
| 9: | 0.221294 0.664219 -0.106292 1 | 0.684258 0.572004 -0.452331 1 | 0.552572 0.727924 0 1 | 389.813 82.3125 1.33866e+007 1.90407 |
| 11: | 0.212335 0.668257 -0.109153 1 | -0.020438 0.568025 -0.822757 1 | 0.475132 0.755465 0 1 | 385.375 81.1875 1.33924e+007 1.90717 |
| 12: | 0.203378 0.676379 -0.103548 1 | -0.129933 0.770604 -0.623928 1 | 0.433008 0.853809 0 1 | 383.875 78.625 1.34106e+007 1.91698 |
| 9: | 0.221294 0.664219 -0.106292 1 | 0.684258 0.572004 -0.452331 1 | 0.552572 0.727924 0 1 | 389.813 82.3125 1.33866e+007 1.90407 |
| 12: | 0.203378 0.676379 -0.103548 1 | -0.129933 0.770604 -0.623928 1 | 0.433008 0.853809 0 1 | 383.875 78.625 1.34106e+007 1.91698 |
| 10: | 0.209451 0.676752 -0.0905832 1 | 0.391867 0.912601 0.116614 1 | 0.538747 0.917651 0 1 | 389.125 78.5625 1.34264e+007 1.92561 |
| 15: | -0.104557 0.455474 -0.197801 1 | -0.0844385 0.0445519 -0.0433012 1 | 0.799871 0.312214 0 1 | 294.5 148.125 1.36514e+007 2.05709 |

Fig. 27

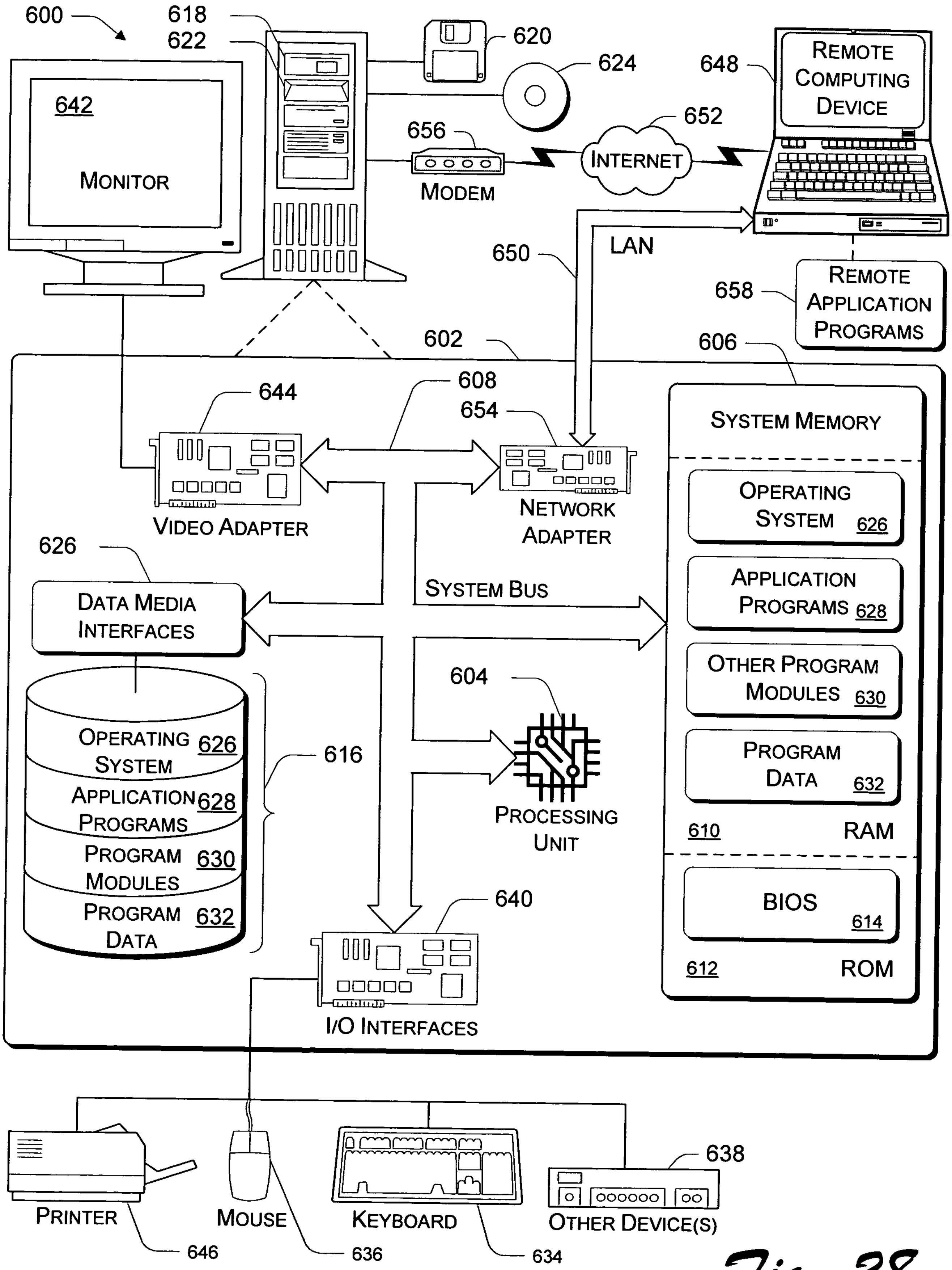

600
618
622
620
624
648
Remote Computing Device
642
Monitor
656
652
Internet
Modem
650
LAN
658
Remote Application Programs
602
606
644
608
654
System Memory
Video Adapter
Network Adapter
Operating System 626
626
Application Programs 628
Data Media Interfaces
System Bus
Other Program Modules 630
604
Operating System 626
Application 628 Programs
616
Program Data 632
Program 630 Modules
Processing Unit
610
RAM
Program 632 Data
640
BIOS
614
612
ROM
I/O Interfaces
638
Printer
Mouse
Keyboard
Other Device(s)
646
636
634

Fig. 28